

THE CHAREAE OF NORTH AMERICA

BY

CHARLES BUDD ROBINSON

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY IN THE FACULTY OF PURE
SCIENCE OF COLUMBIA UNIVERSITY

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The Characeae form a group of slender aquatic plants of very wide distribution, inhabiting fresh, brackish, or very rarely salt water. They are of varied size and habit, their color depending to a considerable extent upon the absence or presence of incrustation, ranging thus from an intense bright-green or dark-green to grayish. They generally form large masses and grow submerged at depths up to at least 12 meters, but most often 2 meters or less, frequently in pools of such a nature that they completely dry at some seasons, the plants accordingly being subjected to extreme changes in environment. They are often very fragile, both when living and dried, whence one of their common names, Brittle-worts; they are also frequently called Stoneworts. Most forms have an unpleasant odor, resembling that of sulphuretted hydrogen. They constitute an extremely natural group, with no very near relatives. Among themselves with a comparatively simple structure they present a great variety of differences, which have made their specific limits difficult to ascertain.

Sexual reproduction takes place by means of antheridia and oogonia. The oogonium originates as a naked cell which elongates and divides by horizontal walls into three, of which the apical becomes ultimately the oöspore, and the middle or stalk cell undergoes no further division, but is usually concealed in the developing sporocarp. The basal cell of the three forms five superficial cells, from each of which a cell begins to grow upward to envelop the oöspore. Each enveloping cell divides into an upper and a lower; the latter elongates and becomes spirally twisted, but does not again divide.

These cells of the lower tier closely invest the oöspore, which after fertilization becomes the oöspore, their lines of contact showing in later development as a series of more or less distinct ridges or striae upon the spore. The number of striae thus seen is accordingly five times the number of turns made by the spiral envelope in the length of the spore, this number ranging from one to three or very rarely more, though nearly definite for a given species. In practice it is always more convenient to count the striae. The five cells

of the upper tier elongate but little and form the crown-cells, which are however raised above the oosphere by the growth of the lower cells, and sometimes again divide by transverse walls, thus forming two superimposed rows, each of five cells. This is taken as the primary basis for dividing the Characeae into two subfamilies, the Chareae with five crown-cells and the Nitelleae with ten. These are further separated, the former into four and the latter into two genera, according to the relative positions of the antheridia and oögonia. Both genera of the Nitelleae, *Nitella* and *Tolypella*, are well represented in North America, the latter perhaps attaining its best development here, though of the Chareae the typical genus *Chara* has alone been reported.

Characeae are either monoecious or dioecious. In *Chara* the antheridia are the terminal cells of metamorphosed leaflets, while the oögonia arise from the basal cells of the leaflets, on their upper side. In the monoecious species both kinds of organs are thus in close proximity to one another, except in a few where the antheridia and the oögonia are at different leaf-nodes though borne on the same plant. In all cases the antheridia tend to develop first, and often fall off before the oöspores mature; great caution must therefore be exercised in calling species dioecious. After fertilization the oögonia increase greatly in size, owing to the growth of the oöspore and the enveloping cells; the resulting body is here called the sporocarp.

The absence or presence of cortication, often a conspicuous feature, was originally considered the chief distinction between the genera, but this has been found misleading. Cortication is never found except in the Chareae, but even in this subfamily many species are entirely uncorticated, one of these apparently having its closest relationships with one of the highest groups of *Chara*.

The development has long been known. On germination, the oöspore divides transversely to its long axis into two cells, a larger which has no further function than to part with its contents to serve as food for the young plant, and a smaller which again divides into two by a wall parallel to the long axis of the spore. One of these two becomes the primary root. The other elongates and divides into a few cells, two of which become nodes, and from the lower of these a number of rhizoids are formed. The upper node divides into two cells, each of which separates off a superficial layer of cells. The first cell of the latter to be formed produces by its successive divisions the entire permanent plant, which thus obviously origi-

nates not as a direct growth from the spore, but as a bud from the pro-embryo. The remaining cells of the upper node give rise merely to rudimentary leaves.

The development of new cells from the growing point proceeds uniformly throughout the entire plant, from the first division in the first formed pro-embryonic superficial node-cell until the cessation of growth, which is more or less indefinite, especially in perennial species.

The growing point or apical cell first divides transversely into two, a new apical cell, and what is known as the segment-cell, the former enlarging somewhat and again dividing similarly an indefinite number of times.

The segment-cells thus formed have a uniform history. Each divides by a transverse wall into two, and the lower of these becomes elongated, its ultimate length being most often from 2 to 10 cm., but it never undergoes further division. Such cells are the internodes. The node or upper division of the segment-cell elongates very slightly, but is capable of division and from it all the remaining parts are produced. It first divides into two, then each of these separates off a superficial cell, which divides into a variable number of cells. These latter, following the same plan of division as the apical cell of the stem, proceed to form long slender organs, called leaves, which maintain the same succession of nodes and internodes, but their number is usually fairly definite in any given species. In the genus *Chara*, a cell segmented off from the inner side of that node-cell which forms the first of these leaves, often gives rise to a branch, which exactly repeats the history of the stem. Branches may be formed at any node, and may even in their turn give rise to branches, in which case the plants may appear bushy in spite of the slenderness of their stems. This appearance is also, and much more frequently, due to luxuriant growth of the leaves or leaflets. From the leaf-nodes leaflets are produced, but these do not divide and are never corticated. On the anterior side of the leaf-nodes, too, the sexual organs, antheridia and oogonia, are borne, and the leaflets surrounding these, known as bracts when the Characeae were considered to be flowering plants, are perhaps better called (though this name too is unsatisfactory) bracteoles. They are usually larger than the leaflets at the sterile nodes. Taking any individual node into consideration, leaflets or bracteoles may be similar or very different; when the latter is the case, the posterior are nearly always the smaller, often greatly reduced, or even wanting.

From the superficial nodal cells of the stems of the Chareae two other classes of outgrowths may arise, simultaneously with the leaves. Outside of the basal cell on which the leaves are borne, a whorl of cells is cut off, which in some species remain undivided, in others form two whorls, or in one non-American species three, lying superimposed in the direction of the axis of the plant. These are here called stipulodes. They sometimes remain quite small; more frequently they elongate without division, resembling the leaflets and the spine-cells.

All of the Nitelleae and some of the Chareae are entirely without cortex, but the great majority of the latter possess one of varying complexity. Sometimes both stem and leaves are corticated, less often the stem only. When present, this cortex originates from the node-cells at the same time as the leaves or leaflets, and completely surrounds the internodes, growing step by step with them so that they are completely enclosed. In extremely rare cases cortical cells are produced which incompletely cover the internodes, as regards either length or circumference.

In its most perfect development the cortex of the stem is formed in the following way. From the basal nodal cell of each leaf one cortical cell grows upwards and one downwards on the surface of the stem-internodes, meeting similar cortical cells from the stem-nodes above and below. The number of these cortical cells is thus the same as that of the leaves, except that no ascending cell is produced by a leaf in whose axil a branch is formed. The original cortical cells cut off nodes and internodes from a terminal cell as in other cases, and, as before, the internodes elongate, often very considerably, but do not divide. The cortical node-cells divide into a deeper one in contact with the stem-internode, and three lying side by side on the surface. The two lateral of these form secondary cortical cells which grow both upwards and downwards, separating the primary ones, meeting corresponding cells from the cortical nodes above and below, and contiguous to similar secondary cells produced by the primary nodes of the rows to the right and the left. It is obvious that the total number of rows of cortical cells is then three times the number of the leaves; the stem is therefore said to be triply corticated. This fact can be ascertained by actually counting leaves and cortical rows. Further, the secondary cortical cells never divide, hence nodal cells are found only in the primary rows, and in most cases the nature of the cortex can be quickly learned by as-

certaining how many rows of secondary cells, if any, lie between two successive primaries. There is yet another aid. The central one of the three superficial cortical node-cells sometimes is small, sometimes large, but very often grows out into a papilla or by further elongation into a spine-cell which may be very long and conspicuous. Spine-cells are never borne except at a cortical node-cell, hence they are often of assistance in locating the latter. Spine-cells usually occur singly, more rarely in pairs or threes, and become more scattered as the cells become mature through the elongation of the intervening cortical internodes. They can never occur except upon corticated stems.

It is unusual to find such perfect or regular development, and deviations from this type are of high diagnostic value in separating species or at least groups of species. In some cases secondary cells develop on both sides of a primary but grow very much more in one longitudinal direction than the other; sometimes they are formed on one side only; sometimes no secondary cells occur, in which case the spine-cells are usually very well developed. The first of these is undoubtedly a case of abnormal triple cortication, but as the number of cortical cells seen in a cross-section would be about twice that of the leaves it has sometimes been described as double; the second case is true double cortication; the last single. All these would cause a reduction in the number of cells seen in a transverse section; at times, however, the ends of two secondary cells slip past one another, thus increasing the number between the primaries for a part of the distance. In most species when they differ the primary cells are larger or more prominent than the secondary; sometimes the reverse is the case.

The cortex of the leaves is much simpler. The number of rows is either once, twice, or thrice that of the leaflets; but all the cortical cells of the leaves are derived from the leaf-nodes, for the cells sent upwards and downwards do not form nodes and internodes but remain undivided, meeting similar cells from the next underlying or overlying nodes near the middle of the internodes. No cortical cell, however, grows upwards on the leaf from its basal node, so that the lowest leaf-internode is corticated only by the cells descending from the leaf-node above it; in some cases these too are wanting and the lowest node of the leaf remains uncorticated. The terminal internodes of the leaves are often uncorticated.

The permanent plants are anchored by long hyaline rhizoids which grow downwards from the lower nodes of the stem.

Reproduction is normally sexual. In some of the dioecious species, antheridia are very rarely found and development must in many cases be parthenogenetic. Vegetative multiplication also takes place in various ways : by bulblets, formed upon either stem or rhizoids, by branches with naked base, or by branches similar in all respects except origin to the pro-embryos.

The systematic eccentricities of the family are of this nature. When thoroughly understood a great majority of the plants collected will fall with perfect distinctness into a few well-marked groups, though more than one under the prevailing nomenclature is spoken of as a species. Yet within the limits of these groups the differences may be very considerable and of the most varied nature. Even a so-called variety may come to comprise plants which show many distinguishing characters. Further, the grouping thus produced sets at defiance all laws of geographical distribution. *Chara fragilis* Desv. is reported from all of the continents; *Chara gymnopitys* A. Br. was originally described from Tasmania, *C. gymnopitys keukensis* Allen from Lake Keuka in New York State. Here the species and so-called variety are very different, though certainly in the same group; in the other case plants from Asia and America greatly resemble one another.

Again, the dioecious *C. canescens* Loisel. is widely distributed in Europe, but male plants have been collected on extremely few occasions. It occurs in eastern America, although here male plants seem unknown. But in the west of America, from the Saskatchewan to California, there occur two extremely similar species, *C. hirsuta* Allen and *C. evoluta* Allen, unquestionably monoecious, and another species frequently identified with the last has been collected in central Asia. *C. canescens*, generally known by its later name *C. crinita* Wallr., in its European acceptance is an aggregate species, but were it not for this one seemingly constant character *C. evoluta* would certainly not be the first species to be segregated from it.

It is at present the custom to divide these blanket species into "forms," and when this is done the latter are almost always found to have a well-marked distribution, limited only too often to a single pool. But so far as evidence is available, there is every reason to believe that each form retains its peculiarities constant for long periods of time. It might seem that the proper course of procedure is to raise these forms to specific rank, but to this there are objections. The number of resulting species not only would be very

great, but it would be impossible to characterize them. The aim here has been to take a middle course. The wide view of species seems entirely untenable, but the effort throughout has been to make the segregations conservatively. Definite measurements are essential to the descriptions and often afford valuable characters. But a *Chara* has but a few nodes and internodes, of necessarily different ages, and the upper ones almost always have different dimensions from the lower and more mature. The data given here are intended primarily to represent the latter, but also to include all parts which have assumed a quasi-final form. Much emphasis has been laid by others upon the size of the spore, and this is often a good character. But spores, like other things, are of different sizes at different ages, and it is extremely desirable to have perfectly mature material. Unfortunately it is often impossible to tell whether a spore is fully mature or not, as the final appearance is reached before it attains its full size.

The observer should guard against another source of error. Besides the normal sporocarps there are found in many species others of a different shape, usually nearly globular except for the crown-cells, the oöspores yellow or orange in color, often glistening, and crowded with starch. Their true significance is not clear, but they afford no characters of systematic importance, except that as a rule the crown-cells resemble those of the normal sporocarps, and the striae upon the oöspore, though fainter, seem to be of the typical number for the species. Oöspores which are either globular or yellow should be viewed with suspicion. A few species in other respects quite distinct are here described with such oöspores. In these cases it is believed that although the species will prove good, and can be recognized by the vegetative characters, the description will require future emendation. The brown oöspores of some of the best-known species are not to be confused with the yellow ones above mentioned.

The most plausible explanation of the name *Chara* is that it was used in ancient times in southern France and northern Italy for *Callitriche* and other allied plants. From the resemblance of its whorled leaves to the inflorescence of the umbellifers, the true *Chara* was first included, and now monopolizes the name. It is much more often said to be a literal rendering of the Greek *χαρά*, joy or delight, supposed by some to indicate their fondness for water, by others their effect when observed by the eye alone ; others connect

it with the idea of a star, as it had previously been given to a constellation. All are guesses, as no explanation was given by Vaillant, who, in 1719, introduced the name.

The species were previously and indeed subsequently included in other groups, *Equisetum* and *Hippuris* especially, now known to be very different, but all plants of more or less similar habitat and habit. The first mention is by Pliny in his Natural History as an *Equisetum* "with leaves like a pine"; but the more modern history of the genus dates from Caspar Bauhin's *Pinax Theatri Botanici* in 1623, where it is called "*Equisetum foetidum sub aqua repens*," and placed between *Sparganium* and *Arundo*. In the first edition of the *Genera Plantarum*, 1737, Linnaeus places them in the Algae between *Pilularia* and *Fucus*; and in the first edition of the *Species Plantarum*, 1753, they are so retained, with four species, though now between *Lichen* and *Tremella*. In 1778, however, Linnaeus transferred them to the flowering plants among the Monoecia Monandria, and this view became very prevalent and persisted for many years. Most of his immediate successors, however, followed his earlier opinion and treated them as cryptogams.

By Adanson, in 1763, they were included in his family *Ara* (aroids), which comprised such genera as *Potamogeton*, *Isoëtes*, *Alga* (= *Zostera*), *Callitriche*, *Myriophyllum*, *Ceratophyllum*, and *Pluvialis* (= *Naias*), between the two last of which *Chara* was placed. In 1789, A. L. de Jussieu put them in the Naiades, between *Hippuris* and *Ceratophyllum*; Ventenat, in 1799, in the ferns after *Equisetum*. The first author to separate them into a family by themselves was Richard, in the botanical account of the voyage of Humboldt and Bonpland, 1815, where they were placed between Marsileaceae and Piperaceae. Their affinity with the Algae has now long been conceded; not universally, however, as Lindley and others have placed them with the mosses, while several writers have considered them to belong to the vascular cryptogams.

As a matter of fact they do not approach very close to any other group, but probably find their nearest affinity with the Coleochaetaceae among the Chlorophyceae, and they should either be made the highest order of this group, as is done in Engler and Prantl's *Pflanzenfamilien*, or made into a separate subkingdom, as by Strasburger.

The researches which led to a correct understanding of the family were carried on by Wallroth, 1815; Vaucher, 1821; Kaulfuss, 1825;

Bischoff, 1828; Pringsheim, 1862; Nordstedt, 1865; and de Bary, 1871. Especial reference must be made to Alexander Braun, who illuminated every phase of the subject. The species were previously very imperfectly understood; many of them were aggregates of little-related forms, but his investigations laid a firm base for all future work. Unfortunately, when a former species or specific name seemed unsatisfactory to him, he promptly discarded it, dealt similarly with names given by himself, and counted mere herbarium names and casual mention as the equivalent of publication. The names adopted by him are still in general use, though in many cases they have been departed from in this paper. More recent works of taxonomic importance are by Migula upon the Characeae of Europe; by H. and J. Groves upon those of the British Isles; and by Nordstedt, whose descriptions include several American forms.

The first generic division was by Agardh in 1824, who separated *Nitella* from *Chara*, taking as the distinguishing character the absence of cortex, still often, though wrongly, so considered. The real nature of these two genera was first shown by Braun, who at a later date, separated *Lamprothamnus* from *Chara*. He also made *Tolypella* a subgenus of *Nitella*; this was raised to generic rank by von Leonhardi, in 1863, who at the same time similarly treated *Lychnothamnus*, first recognized as a section of *Chara* by Ruprecht in 1845. *Chara obtusa* Desv., placed subsequently in *Nitella* and *Lamprothamnus*, was the last of the accepted genera to receive recognition, which came from Hy in 1889, as *Nitellopsis*, and Migula in the succeeding year applied to it the name *Tolypellopsis*, which, however, as a subgenus dated back to von Leonhardi in 1863.

One other genus, *Charopsis*, to comprise uncorticated Chareae, was proposed by Kützing in 1843, with *Chara Braunii* as the type, but this character did not justify segregation, as he himself speedily saw.

The first American reference to this group dates back as far as 1696, when Sloane, in his catalogue of plants of Jamaica, identifies a plant from that island as the *Equisetum foetidum sub aqua repens* of Caspar Bauhin, already mentioned. His species was probably *C. haitensis* Turpin.

The first continental American species to be recognized was *Chara foliolosa*, sent under this name from Pennsylvania by Muhlenberg and described by Willdenow. American botanists confused

with this the widely different *C. Schweinitzii*, distributed by the collector after whom it is called. Braun was from an early date in correspondence with American collectors, especially Engelmann, and almost all publications here have been profoundly influenced by him. Dr. T. F. Allen of New York has been by far the most assiduous collector and student of the family on this side of the Atlantic; he accumulated a very large herbarium, which has made the present paper possible. He projected an extensive work, to include all American representatives of the group, but was unable to complete it. Many species were collected by Charles Wright, botanist of the Mexican Boundary survey, in 1851-2. These passed through the hands of Engelmann, Braun, and Allen, and have often been cited.

The only paper yet published, intended to comprise all North American representatives of the family, was by Halsted, in 1879. The collections upon which it was based were mainly from New England and the total was only 24: *Nitella* 8 species, *Tolypella* 1 species, and *Chara* 9 species and 6 varieties. In *Fragmente einer Monographie der Characeen*, compiled from Braun's notes by Nordstedt after the death of the former, and published in 1882, there are North American identifications under 39 specific headings, 21 in *Nitella*, 3 in *Tolypella*, and 15 in *Chara*, besides which many varieties and forms are recorded.

An important paper covering a limited range is that of Woods in the *Flora of Nebraska*, in which 5 species of *Nitella* and 7 of *Chara* are described and figured.

SYNOPSIS OF THE GENERA OF CHARACEÆ

- | | |
|---|---------------------------|
| Crown-cells in two superimposed rows, each of 5 cells; cortex and stipulodes wanting. | Subfamily NITELLEÆ. |
| Antheridia terminal on the primary ray and secondary divisions of the leaf. | 1. <i>Nitella</i> . |
| Antheridia lateral on the nodes of the leaf, or within the base of the whorl. | 2. <i>Tolypella</i> . |
| Crown-cells in a single row. | Subfamily CHAREÆ. |
| Stipulodes none. | 3. <i>Nitellopsis</i> . |
| Stipulodes present, sometimes reduced. | |
| Sporocarps below the antheridia. | 4. <i>Lamprothamnus</i> . |
| Sporocarps between the antheridia. | 5. <i>Lychnothamnus</i> . |
| Sporocarps above the antheridia or in dioecious species on the upper side of the nodal cell of a leaflet. | 6. <i>Chara</i> . |

The Chareae are alone included in the scope of this paper, and of the four genera, *Chara* is the only one so far collected in North America.

The genus, as here divided, is represented in North America by 50 species, besides many aberrant forms, some of which will doubtless be shown by further study and better material to be worthy of addition to the number. Of these 50 species, 1 is known from Greenland, 11 occur in Canada, 37 in the United States, 17 in Mexico or Central America, and 8 in the West Indies. No one species is however known from all of these divisions, and this remains true even if Braun's specific limits be accepted, in which case the nearest would be his *C. gymnopus*, which has its northern limit in Lake Champlain, is well represented in the United States and Mexico, and is much the predominant form in the West Indies and in Central America.

CHARA L. Sp. Pl. 1156. 1753

Charopsis Kütz. Phyc. Gen. 319. 1843. (Type, *Chara Braunii* C. C. Gmelin.)

Annual or perennial algae, inhabiting fresh, brackish, or salt water, usually gregarious, often fetid. Stems composed of nodes and internodes, the former bearing whorls of leaves, surrounded without by one or two whorls of stipulodes, and often having a branch in the axil of the first formed leaf of the whorl. Leaves similarly divided into nodes and internodes, with longer or shorter leaflets at the former. Sexual reproduction by antheridia and oögonia, the latter in monoecious species lying above the antheridia. Oögonium upon fertilization, or parthenogenetically, developing into a sporocarp, composed of an oöspore, surrounded by an envelope of five spiral cells, and terminating in a single row of crown-cells. Stems uncorticated or corticated, the number of cortical rows 1-3 times the number of leaves, the primary cortical cells forming nodes and internodes. Leaves also uncorticated or corticated, but all cortical cells formed from the node-cells of the leaf. Plants with or without calcareous incrustation; this is most frequent in corticated species.

Type species: *Chara vulgaris* L.

KEY TO THE SPECIES

Stems entirely uncorticated.

Stipulodes forming a single whorl.

Bracteoles shorter than the mature sporocarps; posterior leaflets nearly always wanting.

- Stipulodes short and slender ; oöspores almost always shorter than 0.5 mm. 1. *C. pallida*.
- Stipulodes longer and broader ; oöspores 0.5–0.6 mm. long. 2. *C. Braunii*.
- Bracteoles at least as long as the mature sporocarps. 3. *C. Schweinitzii*.
- Stipulodes forming a double whorl. 47. *C. Brittonii*.
- Stems corticated, at least in part.
- Corticated stem-internodes very incompletely covered by the cells.
- Anterior bracteoles 0.1–0.3 mm. long. 8. *C. hypnoides*.
- Anterior bracteoles 0.4–0.7 mm. long. 9. *C. inconnexa*.
- Corticated stem-internodes completely covered by the cells, or almost so.
- Stems singly corticated, or very small secondary cortical cells sometimes developed.
- Stipulodes forming a single whorl ; leaves entirely uncorticated. 4. *C. crinitiformis*.
- Stipulodes forming a double whorl ; leaves at least partly singly corticated.
- Monoecious.
- Oöspores with 14 or 15 striae. 5. *C. hirsuta*.
- Oöspores with 10–12 striae. 6. *C. evoluta*.
- Dioecious. 7. *C. canescens*.
- Stems doubly corticated.
- Stipulodes forming a single whorl. 16. *C. Morongii*.
- Stipulodes forming a double whorl.
- Primary cortical cells more prominent.
- Oöspore with calcareous coating.
- Primary and secondary cortical cells of nearly equal diameter. 10. *C. Schaffneri*.
- Primary cortical cells wider than secondary.
- Posterior bracteoles very short, or none. 11. *C. contraria*.
- Posterior bracteoles not very short. 12. *C. excelsa*.
- Oöspore without calcareous coating. 13. *C. baltica*.
- Secondary cortical cells more prominent.
- Posterior bracteoles usually twice as long as wide. 14. *C. intumescens*.
- Posterior bracteoles little longer than wide, often wanting. 15. *C. vulgaris*.
- Stems triply corticated, but by imperfect development of some of the secondary cells, usually appearing doubly corticated ; stipulodes forming a single whorl ; at least the basal leaf-internode uncorticated.
- Monoecious.
- Leaves entirely uncorticated.
- Plants only slightly incrustated, usually light-green.

- Stipulodes 0.6–1.1 mm. long.
 Oöspores with 8 or 9 striae. 16. *C. Morongii*.
 Oöspores with 11 or 12 striae. 17. *C. Schneckii*.
 Stipulodes 1.75–3 mm. long.
 Oöspores with 8 striae. 18. *C. coronatiformis*.
 Oöspores with 6 striae. 19. *C. Curtissii*.
 Stipulodes 3.5–8 mm. long. 20. *C. longifolia*.
 Plants somewhat heavily incrustated, grayish. 21. *C. keukensis*.
 Leaves more or less corticated, the basal internode excepted.
 Leaves with one corticated internode.
 Stipulodes 0.2–0.25 mm. long. 22. *C. mexicana*.
 Stipulodes 0.8–1.1 mm. long. 17. *C. Schneckii*.
 Leaves with more than one corticated internode.
 Oöspores 0.4 mm. long. 23. *C. Liebmanni*.
 Oöspores 0.5 mm. long. 24. *C. Robbinsii*.
 Dioecious.
 Spine-cells very short, confined to upper stem-internodes. 20. *C. longifolia*.
 Spine-cells conspicuous on all stem-internodes.
 Leaves not over 2.5 cm. long. 25. *C. Hornemannii*.
 Leaves up to 8 cm. long. 26. *C. Nordhoffiae*.
 Stems usually very regularly triply corticated ; stipulodes forming a double whorl.
 Leaves entirely uncorticated.
 Posterior bracteoles not greatly reduced. 34. *C. inconstans*.
 Posterior bracteoles greatly reduced. 37. *C. guatemalensis*.
 Leaves, or at least the lowest leaf-internodes, doubly corticated.
 Monoecious.
 Oöspores brown. 27. *C. leptosperma*.
 Oöspores black.
 Primary and secondary cortical cells of equal size ; no spine-cells, papillae rare. 28. *C. fragilis*.
 Primary cells larger than secondary ; spine-cells or at least papillae present. 29. *C. verrucosa*.
 Dioecious.
 Spine-cells well developed ; posterior leaflets moderately developed. 30. *C. aspera*.
 No spine-cells ; posterior leaflets greatly reduced. 31. *C. Macounii*.
 Leaves, at least some of them, triply corticated, at least in part ; the lowest leaf-internode always uncorticated.
 Antheridia and oögonia borne at the same nodes.
 Leaflets at the lowest leaf-node linear to ovate, not ventricose, similar to the others.

Some or all leaflets well developed.

Lowest leaf-internode 2-6 times as long as broad.

Posterior bracteoles little reduced, longer than sporocarps.

Spine-cells inconspicuous.

32. *C. cubensis*.

Spine-cells conspicuous.

33. *C. elegans*.

Posterior bracteoles considerably reduced, shorter than sporocarps.

Corticated leaf-internodes 3 or fewer.

34. *C. inconstans*.

Corticated leaf-internodes 4 or more.

Slightly incrustated.

Stipulodes at least as long as the basal leaf-internode.

Posterior bracteoles not very short.

35. *C. filicaulis*.

Posterior bracteoles often very short.

36. *C. fertilissima*.

Stipulodes shorter than the basal leaf-internode. 38. *C. carmenensis*.

Heavily incrustated.

39. *C. Hicksii*.

Lowest leaf-internode only slightly longer than broad.

Posterior bracteoles only slightly reduced; striae on oöspore 10 or 11. 40. *C. stellata*.

Posterior bracteoles half length of anterior; striae on oöspore 14 or 15. 41. *C. Sanctae-margaritae*.

Posterior bracteoles much less than half length of anterior. 42. *C. foliolosa*.

All leaflets at sterile nodes greatly reduced.

43. *C. haitensis*.

Leaflets at the lowest leaf-node ventricose, usually different from the others.

Leaflets at sterile nodes not very short, 0.16 mm. or more.

44. *C. conjungens*.

Leaflets at sterile nodes not exceeding 0.16 mm.

Striae upon oöspore 8-10. 45. *C. indica*.

Striae upon oöspore 12-14.

46. *C. trichacantha*.

Antheridia and oögonia borne at different nodes of the same leaves.

Anterior bracteoles longer than the sporocarps.

48. *C. formosa*.

All bracteoles shorter than the sporocarps.

Upper whorl of stipulodes 0.56-0.82 mm. long, concealing the uncorticated basal leaf-internode.

49. *C. sejuncta*.

Upper stipulodes 0.92-1.5 mm. long, but not concealing the uncorticated basal leaf-internode.

50. *C. compacta*.

1. *Chara pallida* sp. nov.

C. coronata Braunii forma *novi-mexicana* A. Br. Fragm. Monogr. Char. III. 1882.

C. coronata Braunii tenera A. Br.; Allen, Am. Nat. 16: 361. 1882.

C. coronata gracilis Allen, Am. Nat. 16: 362. *pl.* 4. 1882.

Monoeious: 5-20 cm. high, totally unincrusted, or sometimes partially incrustated, then having a mottled appearance; entirely without cortication and therefore without spine-cells; stems 0.6-1 mm. in diameter: stipulodes forming a single whorl at each node, alternate with and equal in number to the leaves, sometimes inconspicuous, 0.25-0.75 mm. long, 0.07-0.1 mm. wide: leaves 7-10 in a whorl, 6-25 mm. long, containing 3-5 internodes besides the terminal cell; leaflets at sterile nodes usually very small, the bracteoles much shorter than or rarely nearly equaling the sporocarps, 0.3-0.9 mm. long, 0.05-0.1 mm. wide, the posterior very short or more often wanting: antheridia 0.26-0.32 mm. in diameter; sporocarps single or in pairs, 0.7-1 mm. long, 0.4-0.48 mm. wide; oöspores 0.42-0.52 mm. long, 0.31-0.35 mm. wide, with 5-7 rather coarse and prominent striae; whorl of crown-cells 0.12-0.21 mm. high, 0.2-0.25 mm. wide at base, the individual cells ovate or subhemispherical with a peaked apex, or subpyriform.

Type collected at Silver City, New Mexico, by H. H. Rusby, 1880; in the herbarium of the New York Botanical Garden.

Distribution: New Mexico to central Mexico.

Illustrations: Am. Nat. 16: 362. *f.* 1; *pl.* 4.

Exsiccatae: Allen, Char. Am. Exsicc. 11.

2. *CHARA BRAUNII* C. C. Gmelin, Fl. Bad. Alsat. 4: 646. 1826

C. coronata Ziz; Bisch. Krypt. Gewäch. 26. 1828.

C. coronata Braunii A. Br. Flora 18: 60. 1835.

Charopsis Braunii Kütz. Phyc. Gen. 319. 1843.

Monoeious: 6-20 cm. high, without incrustation, cortex, or spine-cells: stipulodes forming a single whorl at each node, alternate with and equal in number to the leaves, mostly 0.4-0.8 mm. long and 0.17-0.21 mm. wide, but varying, even on a single plant: leaves 10-12 in a whorl, 1.2-1.8 mm. long, composed of 4 or 5 internodes, besides the short terminal cell; leaflets at sterile nodes up to 0.4 mm. long, or entirely wanting; bracteoles 0.5-0.9 mm. long, 0.08-0.2 mm. wide, the posterior very rarely developed, all

shorter than the sporocarps: sporocarps 0.7–0.84 mm. long, 0.45–0.53 mm. wide; oöspores 0.5–0.6 mm. long, 0.35–0.4 mm. wide, with 6 or 7 striae; whorl of crown-cells 0.1–0.16 mm. high, 0.2–0.23 mm. wide at base, the individual cells lanceolate to ovate, usually connivent.

Type locality: Carlsruhe, Baden, Germany.

Distribution: Vermont to Minnesota and Indian Territory; Europe, Asia, and Africa.

Illustrations: Am. Nat. 16: 362. f. 2; 367. f. 9; Bisch. Krypt. Gewäch. pl. 1, f. 5, as *C. Braunii*; loc. cit. f. 7, as *C. coronata*; Kütz. Tab. Phyc. 7: pl. 43, f. a–e; Migula, Char. Deutsch. Oesterr. Schw. f. 81–83; Migula, Consp. Char. Eur. f. 68, 69; Woods, Flor. Neb. 1: pl. 30. f. 1, 4.

Exsiccatae: Allen, Char. Am. Exsicc. 12.

The common American species of this group is *C. Schweinitzii*, typical specimens of which are quite distinct from the European *C. Braunii* in several important characters. There are also puzzling intermediate forms, but most of these are referable to *C. Schweinitzii*, to which also belong several of the plants placed by Braun and Allen under *C. Braunii*. There remain a few of northern distribution which seem practically identical with European specimens. The southern hitherto assigned to this species are here somewhat tentatively separated.

3. CHARA SCHWEINITZII A. Br. Ann. Sci. Nat. II. 1: 353. 1834

C. coronata Schweinitzii A. Br. Flora 18: 60. 1835.

C. Braunii foliolosa Wallm. Kongl. Vet.-Akad. Handlingar 1852: 286. 1854.

Monoecious: variable in size and habit, 0.1–1.5 m. high, 0.7–1.3 mm. in diameter, usually caespitose, bright- to olive-green, entirely unincrusted or much more rarely lightly or heavily incrusted, never corticated, and therefore without spine-cells: stipulodes forming a single whorl at each node, alternate with and equal in number to the leaves, usually 1.5–3.5 mm. long, and about 0.5–1.5 mm. wide: leaves 8–11 in a whorl, 0.8–5 cm. long, usually exceeding the corresponding stem-nodes, containing 4–6 internodes, besides the short terminal cell; leaflets usually verticillate, the posterior shorter but nearly always developed, the anterior bracteoles 1.3–2.5 mm. long, slightly exceeding to three times as long as the sporocarps, those at sterile nodes usually much shorter, often very small: antheridia and oogonia single or in pairs, the former 0.28–0.32 mm. in diameter; mature sporocarps 0.8–0.92 mm. long, 0.49–0.53 mm. wide; oöspores 0.52–0.65 mm. long, 0.33–0.4 mm. wide, with 9–11 striae;

whorl of crown-cells 0.15-0.18 mm. high, 0.2-0.25 mm. wide at base, the individual cells pyriform.

Type locality : North Carolina.

Distribution : Quebec and Florida to British Columbia and California.

Illustrations : Am. Nat. **16** : 364. *f.* 5; 365. *f.* 6 (?) ; 366. *f.* 7, 8; Allen, Char. Am. *pl.* 3; Woods, Flor. Neb. **1** : *pl.* 30. *f.* 2, 3, 5-7.

Exsiccatae : Allen, Char. Am. Exsicc. 8, 13, 14; Tilden, Am. Alg. 256, 529; Collins, Holden, & Setchell, Phyc. Bor. Am. 822.

This species was originally based upon material sent to Europe by Schweinitz, wrongly labeled *C. foliolosa* Muhl., which is very different. A sheet so named in his handwriting, now in the herbarium of the New York Botanical Garden, is however a *Nitella*, while another labeled by him *C. nidifica* is *C. Schweinitzii*.

4. *Chara crinitiformis* sp. nov.

C. excelsa Allen, Bull. Torrey Club **9** : 43. *pl.* 20, in part. 1882.

Probably dioecious, but only maturing sporocarps have been seen : about 10 cm. high, without calcareous incrustation; stems 0.7 mm. in diameter, regularly singly corticated; spine-cells frequent, usually in pairs, rigid, 1.2-1.6 mm. long, 0.16-0.2 mm. wide, very acute and sometimes falcate at the apex: stipulodes forming a single whorl at each node, twice as numerous as the leaves, similar to the spine-cells: leaves 10-12 in each whorl, 6-8 mm. long, entirely uncorticated; lower leaflets similar to one another and to the stipulodes, the upper somewhat shorter and wider: sporocarps 0.8-0.85 mm. long, 0.62-0.73 mm. wide; oöspores globose, yellowish, mostly 0.47-0.51 mm. long and 0.47 mm. broad, but one presumably more mature 0.63 mm. long and 0.56 mm. wide, 7-striate; whorl of crown-cells depressed-hemispheric, 0.1-0.13 mm. high, 0.23-0.29 mm. wide at base.

Type collected at Canadaigua Lake, New York, by T. F. Allen, August, 1881; in the herbarium of the New York Botanical Garden.

Distribution : Only known from type collection.

Illustration : Bull. Torrey Club **9** : *pl.* 20, *f.* A.

Exsiccatae : *C. excelsa* Allen was distributed in his Char. Am. Exsicc. as *no.* 15, and small quantities of this were doubtless included, as the specimen here described was obtained from undistributed material of that number. *C. excelsa* in all the more important characters belongs to the *contraria* group, but some portions of the description were based on *C. crinitiformis*.

5. *CHARA HIRSUTA* Allen, Bull. Torrey Club 27: 301. *pl.* 10, 11.
1900

Monoecious: 0.5–0.6 m. high, moderately incrustated; stems 0.26–0.62 mm. in diameter, singly corticated, the primary cells almost or completely covering the stem except in the youngest internodes, very small secondary cortical cells rarely developed; spine-cells often forming whorls around the stem, single or more often paired, and then usually unequal, variable, 0.25–1.7 mm. long, 0.05–0.11 mm. wide at base; lower internodes of the stem usually 1.5–2 cm., but reaching 6 cm. in length, the apical 3 or 4 together usually not exceeding 1 cm. in length: stipulodes forming a double whorl at each node, comparatively short, those in the upper whorl 0.38–0.56 mm. long, 0.035–0.05 mm. wide, those in the lower 0.26–0.37 mm. long, 0.03–0.04 mm. wide: leaves 10–12 in a whorl, 7–11 mm. long, containing 5 or 6 internodes, very slender, rarely more than 0.2 mm. in diameter at their bases, and little more than half this near their apices, cortex single, completely covering the leaves or leaving irregular, elongated interstices; leaflets 6–8 at the sterile nodes, forming a similar whorl at the apex, 0.4–1.4 mm. long, 0.07–0.09 mm. wide, the bracteoles attaining a length of 1.7 mm., all bracteoles exceeding the mature sporocarps, the anterior the longest: antheridia 0.3–0.35 mm. in diameter; sporocarps 0.84–1 mm. long, 0.31–0.37 mm. wide; oöspores 0.63–0.68 mm. long, 0.23–0.25 mm. wide, truncate at both ends, with 14 or 15 striae; whorl of crown-cells about 0.09 mm. high, 0.18 mm. wide at base, the individual cells nearly square, but with rounded angles.

Type locality: Lakeside, San Diego County, California.

Distribution: Only known from type locality.

Illustrations: Bull. Torrey Club *loc. cit.*

Exsiccatae: Allen, Char. Am. Exsicc. 11a.

6. *CHARA EVOLUTA* Allen, Bull. Torrey Club 9: 41. *pl.* 19.
1882

Monoecious: (1 cm. *vide* Allen) 7–15 cm. high, very slightly incrustated; stems 0.125–0.525 mm. in diameter, singly corticated, the cortical node-cells nearly but not always forming secondary cells, which in rare cases develop into secondary cortical cells; spine-cells single, in pairs, or in threes, often forming whorls around the stem, linear or linear-lanceolate, 0.3–1.6 mm. long, 0.08–0.16 mm. wide: stipulodes forming a double whorl at each node, somewhat variable, linear, those in the upper whorl 0.5–1 mm. long, 0.07–0.09 mm. wide, those in the lower whorl one-half to two-thirds of this length: leaves 9 or 10 in each whorl, 4–6 mm. long, 0.2–0.27 mm. wide, containing 4 or 5 singly corticated internodes, and an uncorticated one- or two-celled tip; leaflets unequal or nearly equal, but all developed, 0.45–1.4 mm. long, those at the fertile similar to those at the sterile

nodes, except that the former often have a short additional leaflet or pre-bracteole on each side of the oogonium, as in *C. canescens*, these usually 0.25–0.4 mm. long: antheridia 0.31–0.34 mm. in diameter; mature sporocarps 0.72–0.88 mm. long, 0.4–0.5 mm. wide; oöspores oval, 0.58–0.68 mm. long, 0.33–0.37 mm. wide, with 10–12 inconspicuous striae; whorl of crown-cells 0.1–0.14 mm. high, 0.2–0.22 mm. wide at base, the individual cells somewhat connivent or becoming spreading, apparently easily deciduous.

Type locality: Red Deer Lakes and ponds west of the Saskatchewan, Alberta.

Distribution: Alberta to South Dakota and California.

Illustrations: Bull. Torrey Club *loc. cit.*; Woods, Flor. Neb. 1: *pl.* 34.

Exsiccatae: Allen, Char. Am. Exsicc. 16.

7. *CHARA CANESCENS* Loisel. Not. Fl. France 139. 1810

C. crinita Wallr. Annus Bot. 190. 1815. — Allen, Bull. Torrey Club 2: 10. 1871; 9: 40. *pl.* 18. 1882. — Halsted, Proc. Boston Soc. Nat. Hist. 20: 181. 1879. — A. Br. Fragm. Monogr. Char. 137. *pl.* 7. *f.* 221, 222. 1882.

C. crinita americana Allen, Char. Am. *pl.* 2. 1879; 5. *pl.* 2. 1880.

Dioecious, antheridia very rare on European specimens, and as yet unknown on American: 6–15 cm. high, dark-green, or becoming yellowish-green when dry, only rarely incrustated, and then but slightly; stems 0.28–0.44 mm. in diameter, singly corticated, the cortical cells usually short and parallel to the direction of the stem, the cortical node-cells normally bearing three spine-cells, 0.4–1.6 mm. long, 0.07–0.09 mm. wide, obtuse to subacute at the apex, often hiding the stem, much more rarely somewhat distant: stipulodes forming a double whorl at each node, those in the upper whorl 0.48–0.75 mm. long, 0.07–0.09 mm. wide, those in the lower equally wide but only 0.25–0.53 mm. long: leaves 8–10 in each whorl, 5–8 mm. long, singly corticated, except the uncorticated tip, which resembles the ultimate whorl of leaflets by which it is surrounded; leaflets and bracteoles similar to one another, 0.5–1.4 mm. long, usually 6 in number, with two between which the sporocarp is situated much smaller than the others, becoming at the extreme reduction only one-fourth the length of the mature sporocarps: sporocarps 0.7–0.84 mm. long, 0.42–0.5 mm. wide; oöspores elliptic or obovate-elliptic 0.53–0.63 mm. long, 0.31–0.38 mm. wide, with 9–11 striae; whorl of crown-cells 0.08–0.09 mm. high, 0.13–0.18 mm. wide at base, the individual cells connivent or slightly spreading.

Type locality: Toulon, France.

Distribution : Massachusetts to Long Island ; Europe, Asia, and Africa.

Illustrations : Bull. Torrey Club *loc. cit.* ; A. Br. Fragm. Monogr. Char. *loc. cit.* ; Kütz. Tab. Phyc. 7 : *pl. 69. f. 1* ; Migula, Char. Deutsch. Oesterr. Schw. *f. 87-90* ; Migula, Consp. Char. Eur. *f. 73-75* ; E. & P. Natürl. Pflanzenfam. *f. 128* ; Allen, Char. Am. *loc. cit.*

8. *Chara hypnoides* sp. nov.

Monoecious, the antheridia and oogonia probably always borne upon the same leaf-nodes : 3-5 cm. high, caespitose, not incrusting ; stems 0.3-0.45 mm. in diameter, the lowest internodes entirely uncorticated, the upper internodes either singly corticated, with the cells incompletely covering the stem, or with secondary cells more or less developed, but the primary the more projecting, and the stem nearly or completely covered ; spine-cells wanting, but the cortical node-cells sometimes forming oval to depressed-globose papillae, 0.03-0.1 mm. long : stipulodes often inconspicuous, forming a double whorl at each node, the number in each whorl twice that of the leaves, those in the upper whorl oval, 0.09-0.13 mm. long, those in the lower oval to globose, 0.05-0.1 mm. long : leaves 6-8 in a whorl, often entirely uncorticated and then usually 3-celled and not developing nodes and internodes, or uncorticated but forming nodes and internodes, or the first one, two, or three internodes singly corticated, the cortex-cells in contact with one another laterally or more or less separated, terminal leaf-cells sometimes only 0.1 mm. long, ovate ; leaflets at the sterile nodes reduced to papillae, or the anterior fascicled and attaining a length of 0.4 mm. ; anterior bracteoles 0.1-0.3 mm. long, shorter than the sporocarps at any stage, the lateral and posterior bracteoles still shorter, not exceeding 0.175 mm., usually less : antheridia early deciduous, 0.32-0.37 mm. in diameter ; the oogonia and sporocarps often in pairs, the latter (probably not quite mature) observed up to 0.63 mm. long 0.4 mm. wide, the oöspores up to 0.44 mm. long and 0.37 mm. wide, with 8 striae, the crown-cells 0.07-0.14 mm. high, ovate-globose.

Type collected in shallow water in the crevices of rocks, along the borders of an island on the east side of Lake Nipigon, Ontario, by John Macoun, *no. 6*, July 16, 1884 ; in the herbarium of the New York Botanical Garden.

Distribution : Only known from original collection.

A distinct and very curious species, placed by Dr. Allen near the dioecious *C. imperfecta* A. Br. from Algeria ; probably even closer to European specimens of *C. dissoluta* A. Br. ; with important resemblances to and sharp distinctions from both.

9. CHARA INCONNEXA Allen, Bull. Torrey Club 9: 40.

pl. 17. 1882

Monoecious, the antheridia and the oögonia at the same leaf-nodes: 3.5-4.5 cm. high, moderately incrustated; stems 0.17-0.37 mm. in diameter, entirely uncorticated below, above singly corticated, the cells not adjoining laterally, and therefore not completely covering the stem, secondary cortical rows not developed, though minute cells are sometimes seen on either side of the cortical node-cells; spine-cells entirely wanting: stipulodes oval to globose, small and inconspicuous, 0.07-0.11 mm. long, forming a double whorl at each node, the number in each whorl twice that of the leaves, or compressed into a single whorl, or entirely wanting: leaves 7 or 8 in a whorl, 1-2 cm. long, those at the lowest node uncorticated, nitelloid, not forming nodes and internodes, usually composed of two long cells and a much shorter terminal one; leaves in the upper whorls sometimes naked, or partly doubly corticated or partly singly corticated like the stem, or both; no leaflets found at sterile nodes, probably there are none; anterior bracteoles 0.4-0.7 mm. long, much shorter than the mature sporocarps: antheridia 0.25-0.33 mm. in diameter; mature sporocarps 0.9-1.1 mm. long, 0.56-0.6 mm. wide; oöspores 0.54-0.6 mm. long, 0.4-0.42 mm. wide, with 8-10 striae; crown-cells each about 0.09 mm. high and 0.12 mm. wide, somewhat truncate.

Type locality: Storm Lake, Iowa.

Distribution: Only known from original collection.

Illustration: Bull. Torrey Club *loc. cit.*

10. CHARA SCHAFFNERI A. Br. Fragm. Monogr. Char. 146.

1882; as subspecies

Monoecious: resembling in habit *C. fragilis pulchella*, but differing very widely from it in the nature of the cortex and spine-cells, and approaching nearest to *C. tenuispina*, but seems to differ from it by being doubly corticated, color varying from bright- or golden-green to dark-green, incrustation slight; stems 0.5-0.6 mm. in diameter, doubly corticated, partition walls of the secondary cells at right angles to their length, rarely slanting; spine-cells single, scattered, projecting horizontally, or in the upper part of the internode weak, sloping downwards, conical, very sharp, 0.06-0.14 mm. long, at the base 0.05-0.06 mm. wide (Braun's description reads "1.05-6 mm.," supposed to be a misprint for preceding): stipulodes forming a double whorl at each node, more strongly developed than in *C. fragilis*, those in the upper whorl somewhat longer than those in the lower, appressed respectively to the leaves and the stem: leaves 9 or most often 10 in a whorl, 0.4-1.2 cm. long, ascending and straight, or slightly incurved, or the tip occasionally squarrose, about 0.18 mm. in diameter, containing 4-6, usually 5,

corticated internodes of almost equal length, the basal internode neither shortened nor uncorticated, and a 1- or 2-celled uncorticated leaf-tip, which is somewhat shorter than, or sometimes as long as, the last corticated internode; 10 (on upper) to 14 (on lower internodes) cortical cells seen in a cross-section of the leaf; leaflets present at all corticated nodes, as bracteoles the anterior mostly 4 in number, elongated, $1\frac{1}{2}$ -2 times as long as the sporocarps, 0.07-0.11 mm. in diameter, the 3 or 4 posterior much shorter, conical: antheridia 0.24 mm. in diameter; sporocarps oblong, 0.6-0.64 mm. long, 0.32-0.35 mm. wide; oöspores dark-brown, 0.46 mm. long, 0.3 mm. wide; crown-cells rather short and blunt, sometimes connivent, sometimes slightly diverging, 0.07-0.1 mm. high, 0.14 mm. wide.

Type locality: Valley of Mexico.

Distribution: Mexico.

11. CHARA CONTRARIA A. Br.; Kütz. Phyc. Germ. 258. 1845

Monoecious: 10-50 cm. high, lightly or more often heavily incrusting, and accordingly ranging in color from bright-green to gray; stems 0.4-0.9 mm. in diameter, normally doubly corticated, with the primary cortical rows projecting beyond the secondary, or less often rows of both orders nearly equally prominent, or by the ends of the secondary cells overlapping becoming in part triply corticated; spine-cells conspicuous only on the uppermost internodes, 0.09-0.63 mm. long, ranging to mere papillae on the mature internodes: stipulodes forming a double whorl at the nodes, usually very small and inconspicuous, or sometimes more or less compressed into a single whorl, or corresponding stipulodes of the upper and lower whorl not situated directly above one another: leaves 6-10 in a whorl, 0.5-3 cm. long, sometimes entirely uncorticated, or more often with 1-5 corticated internodes, and an uncorticated 1-5-celled leaf-tip; leaflets usually very short, rarely reaching 0.6 mm. long, the anterior nearly always the longer; anterior bracteoles 0.6-3 mm. long, posterior most often reduced to papillae, sometimes entirely wanting, rarely up to 0.35 mm. long: antheridia and oögonia rarely in pairs, found not only at nodes between corticated internodes or at the node terminating the corticated portion of the leaf, but also at nodes where the internodes both above and below are uncorticated; antheridia 0.3-0.58 mm. in diameter; sporocarps 0.88-1.1 mm. long, 0.5-0.65 mm. wide; oöspores black or dark-brown, 0.6-0.72 mm. long, 0.35-0.49 mm. wide, with 10-13 striae; whorl of crown-cells 0.12-0.16 mm. high, 0.22-0.28 mm. wide at base, the individual cells oblong, rounded at the apex, erect but not connivent.

Type locality: Germany.

Distribution: Quebec and Alaska to Mexico; Europe, Asia, Africa, and Australia, according to Braun.

Illustrations: Kütz. Tab. Phyc. 7: *pl. 61*; Jour. Bot. 19: *pl.*

224. f. 2-2c; Migula, Char. Deutsch. Oesterr. Schw. f. 99-104; Migula, Consp. Char. Eur. f. 84-89; Woods, Flor. Neb. 1: pl. 31.

Exsiccatae: Allen, Char. Am. Exsicc. 4-6, 19; Tilden, Am. Alg. 121; Collins, Holden, & Setchell, Phyc. Bor. Am. 1197.

12. CHARA EXCELSA Allen, Bull. Torrey Club 9: 43. pl. 20.

1882

Species inquirenda; as originally described a curious mixture, the most diverging component separated here as *C. crinitiformis*; the more important parts of the original description taken from, and almost all the herbarium material composed of, two forms, both possibly reducible to *C. contraria*, but requiring further collections: monoecious: 6-14 cm. high, grayish from the somewhat heavy incrustation; stems 0.2-0.62 mm. in diameter, mostly regularly doubly corticated, with the primary cells of greater diameter and more prominent, or with the ends of two secondary cells intervening between consecutive primary rows, or with some internodes entirely uncorticated; spine-cells 0.12-0.24 mm. long or reduced to papillae: stipulodes forming a double whorl at the nodes, those in the upper whorl 0.09-0.61 mm. long, those in the lower 0.12-0.32 mm. long, or wanting entirely at nodes intervening between uncorticated internodes; leaves 7 or 8 in a whorl, 0.8-3.2 cm. long, containing usually 3 or 4 doubly corticated internodes, with an uncorticated 2- or 3-celled leaf-tip, the longest leaves with only one corticated internode and an uncorticated 5-celled leaf-tip, or some leaves entirely uncorticated but still fertile; leaflets or at least the posterior extremely variable, as bracteoles the anterior 1.1-2.15 mm. long, usually far exceeding the sporocarps, the posterior bracteoles 0.1-0.8 mm. long; antheridia 0.32-0.35 mm. in diameter; sporocarps 0.8-1.05 mm. long, 0.44-0.6 mm. wide; oöspores 0.54-0.75 mm. long, 0.38-0.44 mm. wide, these figures imperfectly representing the facts, as the shortest set of oöspores belongs to the longest sporocarps, the anomaly being due to the abnormal prolongation of the neck, the crown-cells being 0.2-0.25 mm. high; oöspores with 11-15 striae.

Type locality: Canadaigua Lake, New York.

Distribution: Only known from original collection.

Illustration: Bull. Torrey Club *loc. cit.* excl. f. A.

Exsiccatae: Allen, Char. Am. Exsicc. 15.

Many of the most glaring discrepancies of this description are due to the difference between the two forms, but not all, as great variation may occur upon a single leaf. Both forms may be abnormal, and the species, even with *C. crinitiformis* excluded, is of very doubtful value.

Chara intermedia A. Br. (not the oldest name) has been reported from America by several authors, and many sheets so named are in the Allen herbarium, the range thus assigned being from Maine, Quebec, and Alaska, to New Jersey, Texas, Mexico, Southern California, and even Chile. A careful examination of every determinable sheet so named in the Allen herbarium has enforced a profound conviction that this species is not found in America. The true *C. intermedia* should be characterized, as distinguished from *C. contraria*, by better developed stipulodes and spine-cells, by having all the leaflets at sterile nodes nearly equally developed, and the posterior at fertile nodes not greatly reduced; the oöspores should be dark-brown, 0.66–0.82 mm., very rarely under 0.7 mm. long, 11-striate. The American plants usually have inconspicuous stipulodes; spine-cells are extremely rare; the leaflets can very rarely be considered equal, and then only when all are very small; the posterior bracteoles are greatly reduced; repeated measurements of oöspores, apparently fully mature and from widely separated localities, gave lengths from 0.51–0.665 mm., mostly 0.58–0.65 mm., only two getting within the minimum limits for the species. They are, moreover, much more slender than the European plants. On the contrary, so far as can be judged from dried material, the plants have the pinkish-green color of *C. intermedia*, the oöspores are dark-brown and never have the sooty color so common in *C. contraria*, and there are 11 or 12 striae. None of the three collection numbers doubtfully assigned to this continent by Braun have been seen, but from his description, and the examination of plants undoubtedly similar from kindred localities, it is believed they also are to be excluded from the species. It is hard to believe that they really represent *C. contraria*, but that is certainly their nearest affinity, and they are so placed for the present.

C. hispida L. is reported from New York State, but no American material so assignable has been seen, and it is not here included.

13. CHARA BALTICA (Hartm.) Fries & Asp.; Bruz. Obs. Gen. Char. 11, 19. 1824

C. hispida baltica Hartm. Handb. Skand. Fl. 376. 1820.

Monoecious: marine, or in brackish water, 2–90 cm. high, not visibly incrusting; stems mostly 0.6–0.8 mm. but reaching 1.5 mm. in diameter, with typical double cortication, the primary cortical rows projecting somewhat beyond the secondary; spine-cells numerous on all stem-internodes, borne singly, or in fascicles of 2–4, of

variable size and shape, at the extreme their length greater than the diameter of the stem: stipulodes forming a double whorl at each node, well developed, resembling the spine-cells, those in the upper whorl generally somewhat longer than those in the lower: leaves 8-11 in a whorl, 0.5-1.0 cm. long, containing 5-7 internodes, doubly corticated except usually one, more rarely 2 or even 3 terminal internodes, which are uncorticated, the leaf-tip 1-3-celled; leaflets variable, at sterile nodes the posterior not or only slightly shorter than the rest, as bracteoles the lateral the longest, ranging from less than the length of the sporocarps to ten times the length of the latter, the posterior from mere papillae to almost the length of the anterior: antheridia 0.5-0.8 mm. in diameter, rarely less than 0.55 mm.; sporocarps large, ovate to ovate-globose, with a maximum length of 1.3 mm. and width of 0.8 mm.; oöspores without calcareous coating, black or brownish-black, 0.7-0.86 mm. long, 0.45-0.5 mm. wide, with 11-14 striae; whorl of crown-cells about 0.24 mm. high, 0.22 mm. wide, the individual cells oblongate.

Type locality: Scandinavia.

Distribution: Greenland; shores of the Baltic and England. Braun says that the Greenland plant has greatly elongated internodes, short leaves, and small spines.

Illustrations: Kütz. Tab. Phyc. 7: *pl.* 63. *f.* 2, *pl.* 64. *f.* 1; Jour. Bot. 19: *pl.* 224. *f.* 1-1c; A. Br. Fragm. Monogr. Char. *pl.* 7. *f.* 232; Migula, Char. Deutsch. Oesterr. Schw. *f.* 114-117; Migula, Consp. Char. Eur. *pl.* 99-102.

14. *Chara intumescens* sp. nov.

C. foetida crassicaulis Halsted, Proc. Boston Soc. Nat. Hist. 20: 187. 1879.

C. crassicaulis Woods, Flor. Neb. 1: 127. *pl.* 33. 1894. Not *C. crassicaulis* Schleicher.

Monoecious: very similar in habit and closely allied to *C. crassicaulis*, 12-35 cm. high, dull- or slightly brownish-green, fragile, heavily incrustated; stems 0.63-1.25 mm. in diameter, doubly corticated, the secondary cortical rows more prominent than the primary, but all of nearly equal diameter, 0.08-0.15 mm., in young internodes occasional cell-ends slipping past one another interpose two secondary cells between consecutive primaries but for a short distance only; the cortical node-cells bearing spine-cells 0.13-0.35 mm. long, less often papillae only, or in a Mexican plant spine-cells 0.35-1.7 mm. long: stipulodes forming a double whorl, but somewhat variable in length even at a single node, those in the upper whorl 0.21-0.49 mm. long, those in the lower 0.16-0.45 mm. long: leaves 6-10, usually 9 in a whorl, 0.9-1.5 cm. long, containing sometimes 1, usually 2 or 3, rarely 4, doubly corticated internodes,

followed by an uncorticated 2-4-celled leaf-tip which is not divided into nodes and internodes, the lowest of the uncorticated cells usually 0.5-0.66 mm. wide, usually exceeding the corticated leaf-internodes or even in the upper stem-internodes the diameter of the latter, or sometimes the leaves entirely uncorticated; no leaflets or reproductive organs borne except where at least the internode next below is corticated; the anterior bracteoles very rarely shorter than, usually exceeding, more often greatly exceeding the sporocarps, 1.1-2.4 mm. long, 0.1-0.32 mm. wide, the longer usually also the wider, posterior bracteoles 0.12-0.33 mm. long, 0.06-0.1 mm. wide, varying from only slightly longer to nearly four times as long as wide: antheridia 0.4-0.53 mm. in diameter; sporocarps 0.96-1.1 mm. long, 0.54-0.6 mm. wide; oöspores 0.56-0.63 mm. long, 0.39-0.44 mm. wide, with 10-13 striae; whorl of crown-cells 0.15-0.19 mm. high, 0.25-0.3 mm. wide at base, the individual cells oblong-ovate or suborbicular, truncate at the apex, usually slightly spreading.

Type collected in a saline marsh, fed by water from a sulphurous spring, Garfield Beach, Great Salt Lake, Utah, by P. A. Rydberg and E. C. Carlton, *no. 6919*, July 15, 1905; in the herbarium of the New York Botanical Garden.

Distribution: Gaspé; N. W. Canada (without definite locality) to Mexico. Some Ontario collections are doubtfully referred here, but may barely possibly be the true *C. crassicaulis*.

Illustration: Woods, Flor. Neb. *loc. cit.*

15. CHARA VULGARIS L. Sp. Pl. 1156. 1753

C. foetida A. Br. Ann. Sci. Nat. II. 1: 354. 1834.

Monoecious: of varied habit, 4-40 cm. high, bright-, pale-, or brownish-green, lightly or somewhat heavily incrustated, as a rule exceptionally fetid even for the genus; stems 0.5-1.2 mm. in diameter, doubly corticated, the secondary cortical rows somewhat wider and more prominent than the primary, the cortical node-cells forming small papillae or very rarely short spine-cells: stipulodes forming a double whorl at each node, but very slightly developed, usually inconspicuous, about 0.1-0.15 mm. long, less often reaching 0.25 mm., those in the upper whorl often slightly longer than those in the lower: leaves 6-11 in a whorl, 0.8-3 cm. long, containing 1-4, usually 3 or 4, corticated internodes, and an uncorticated 1-5-, usually 3- or 4-celled leaf-tip, the leaves in the lowest whorl and sometimes elsewhere uncorticated, but then without differentiation into nodes and internodes; antheridia, oögonia, and leaflets borne only where at least the preceding internode is corticated; the anterior bracteoles most frequently 4, sometimes shorter than the sporocarps, but usually very much longer, 0.8-4.5 mm. long, the posterior very small, ovate or orbicular, 0.08-0.11 mm. in length and nearly or quite of equal

width, or entirely wanting: antheridia 0.25–0.55 mm. in diameter; sporocarps 0.75–1.1 mm. long, 0.45–0.6 mm. wide; oöspores light-brown to black, 0.42–0.63 mm. long, 0.28–0.42 mm. wide, with 10–14 striae; whorl of crown-cells 0.1–0.2 mm. high, 0.21–0.28 mm. wide at base, the individual cells oblong, erect.

Type locality: Europe.

Distribution: Very widely distributed throughout North America, though with a more southern range than *C. fragilis*, and apparently not in the West Indies. Nearly cosmopolitan; the commonest of all species of *Chara*.

Illustrations: Bauhin, Prodr. ed. 2. 25. f.; Schnitzl. Iconogr. Fam. pl. 4; Kütz. Tab. Phyc. 7: pl. 58. f. 1; pl. 59; pl. 60. f. 1; J. E. Smith, Engl. Bot. 5: pl. 336; Ganterer, Oesterr. Char. pl. 2. f. 13; Jour. Bot. 18: pl. 208. f. 8; Migula, Char. Deutsch. Oesterr. Schw. f. 121–126; Migula, Consp. Char. Eur. f. 106–111; Woods, Flor. Neb. 1: pl. 32.

Exsiccatae: Allen, Char. Am. Exsicc. 17, 18; Tilden, Am. Alg. 120, 254, 369.

The American representatives of this species seem to have larger antheridia and sporocarps than the European. The minimum dimensions for these organs given above were taken from Migula.

16. *Chara Morongii* sp. nov.

Monoecious: 4–5 cm. high, yellowish-green to dull-green, very slightly incrustate; stems 0.26–0.38 mm. in diameter, with very irregular cortication, the primary cortical node-cells usually forming secondary cells on one side only, leaving uncorticated spaces sometimes of regular but more often irregular outline, or more rarely no secondary cells formed; the cortex usually appearing double, or more rarely triple or single; spine-cells linear-lanceolate, lanceolate, or triangular, 0.1–0.35 mm. long, 0.05–0.08 mm. wide, mostly acute at the apex: stipulodes forming a single whorl at each node, twice as many as the leaves, 0.6–1 mm. long, 0.1–0.12 mm. wide, linear-lanceolate, acute at the apex: leaves 6 or 7 in each whorl, 2–4 mm. long, containing 2–4 internodes besides the terminal cell, entirely uncorticated, about 0.15–0.25 mm. in diameter; leaflets nearly equal, very similar to the stipulodes, 0.7–0.9 mm. long, 0.12–0.14 mm. wide, acute or rarely obtuse at the apex, as bracteoles nearly twice the length of the sporocarps: antheridia 0.23–0.26 in diameter; sporocarps, probably immature, nearly spherical apart from the crown-cells, the largest 0.42 mm. long, 0.39 mm. wide; oöspores 0.32 mm. long, 0.33 mm. wide, with 8 or 9 striae; whorl of crown-cells 0.07–0.09 mm. high, about 0.12 mm. wide at the base, the individual cells lanceolate-oblong, spreading.

Type collected at Bar Lake, Michigan, by Thomas Morong, *no.* 10, 1882; in the herbarium of the New York Botanical Garden.

Distribution: Only known from the original collection.

17. *Chara Schneckii* sp. nov.

Monoecious: 8–13 cm. high, somewhat yellowish-green, slightly incrustated; stems 0.45–0.5 mm. in diameter, the cortex unusually regular for the group, the cells, at least in the lower internodes, long and straight, the cortical node-cells usually developing secondary cells on both sides, but these, nearly always growing more strongly either upwards or downwards, thus leaving most often one, more rarely two, secondary cells between consecutive primary cells, the cortex theoretically triple thus appearing about double, interstices sometimes occurring; spine-cells rare on lower internodes, more frequent above, 0.22–0.48 mm. long, 0.05–0.07 mm. wide, somewhat obtuse at the apex: stipulodes forming a single whorl at each node, twice as many as the leaves, 0.8–1.1 mm. long, 0.09–0.12 mm. wide, acutish at the apex: leaf-whorls distant below, approximate or overlapping at the apex, containing 12–14 leaves, these 5–10 mm. long, composed of 4–6 internodes, entirely uncorticated, or occasionally the second lowest internode double corticated; leaflets 1–1.2 mm. long, 0.1–0.14 mm. wide, at the uppermost node about half this, shorter than the terminal cell of the leaf, as bracteoles $1\frac{1}{2}$ –2 times as long as the sporocarps: antheridia 0.21–0.23 mm. in diameter; sporocarps 0.65–0.7 mm. long, 0.42–0.46 mm. wide; oöspores 0.46–0.49 mm. long, 0.28–0.33 mm. wide, with 11 or 12 striae; whorl of crown-cells 0.07–0.09 mm. high, 0.14–0.15 mm. wide at base, the individual cells triangular-ovate, suberect.

Type collected at Mount Carmel, Illinois, by J. Schneck, Aug. 17, 1895; in the herbarium of the New York Botanical Garden.

Distribution: Only known from original collection.

18. *Chara coronatiformis* sp. nov.

Monoecious: very similar in habit to *C. Schweinitzii*, but closely allied to *C. keukensis*, with which it agrees in the cortex, the number of stipulodes, and the entirely uncorticated leaves: 5–7 cm. high; stems 0.35–0.55 mm. in diameter, almost destitute of incrustation; spine-cells variable in length, most frequently 0.9–1.4 mm. long, 0.07 mm. wide: stipulodes larger than in *C. keukensis*, 1.75–2.1 mm. long, 0.17–0.2 mm. wide: leaves 1 cm. long, their lower internodes about 0.35 mm., the upper 0.2 mm. in diameter; leaflets at median nodes 1.7–1.9 mm. long, reduced at the uppermost node, mostly 0.16–0.19 mm. wide, not exceeding the diameter of the terminal cell of the leaf: antheridia 0.28–0.32 mm. in diameter; sporocarps, doubtfully normal, but if so probably mature, 0.57–0.6 mm. long, 0.44–0.46 mm. wide; oöspores orange, spherical, 0.35–0.37 mm. long, 0.35–0.38 mm. wide, the striae 8, almost imperceptible.

Type: " Van Buren Co., August, 1838, ex herb. I. C. Martindale "; in the herbarium of the New York Botanical Garden. Believed to be from southern Michigan.

Distribution: Only known from original collection.

19. *Chara Curtissii* Allen, sp. nov. [Bull. Torrey Club 7: 107, nomen. 1880]

Monoecious: 10–15 cm. high, lightly incrustated; stems 0.5–0.6 mm. in diameter, somewhat irregularly corticated, the cortical node-cells more usually giving off secondary cells on both sides, but sometimes on one side only, these secondary cortex-cells being nearly always of less diameter than the primary, and of very unequal length, sometimes becoming very narrow, the cortex, essentially triple, thus appearing double or even single; spine-cells scattered, linear-lanceolate or lanceolate, 0.2–0.44 mm. long, 0.06–0.09 mm. wide; stipulodes forming a single whorl at each node, twice the number of the leaves, foliose, 2–2.8 mm. long, 0.26–0.32 mm. wide, narrowly elliptic-lanceolate, acute at the apex: leaves 8–10 in a whorl, 1–1.2 mm. long, 0.39–0.46 mm. wide, usually containing four internodes, besides the terminal cell, entirely uncorticated; leaflets at each node subequal or very unequal, as bracteoles attaining a maximum length of over 2 mm., usually 0.25–0.3 mm. wide, narrowly elliptic, greatly exceeding the sporocarps: antheridia 0.28–0.35 mm. in diameter; sporocarps variable, probably due to incomplete maturity, the oldest 0.57–0.6 mm. long, 0.5 mm. wide; oöspores 0.4–0.42 mm. long, 0.37–0.39 mm. wide, with about 6 striae; whorl of crown-cells 0.08–0.12 mm. high, 0.2 mm. wide at base, the individual cells ovate, very shortly and obtusely beaked.

Type collected in a shallow saw-grass pond, 2 or 3 miles east of the Halifax River, Volusia County, Florida, by A. H. Curtiss, May 25, 1879; in the herbarium of the New York Botanical Garden.

Distribution: Only known from original collection.

Illustration: Allen, Char. Am. 55. f. 50, as *C. flaccida*.

20. *Chara longifolia* sp. nov.

Monoecious or appearing dioecious: 15–30 cm. high, bright-green, very slightly incrustated; stems 0.8–1.2 mm. in diameter, cortication irregular, the primary rows often not straight, the node-cells forming secondary cells on either side, these usually developing in one direction only, the cortication thus numerically about double, or often two primary cells having two secondaries between them, sometimes none, irregular interstices occasionally found; spine-cells found only on the youngest internodes, ovate, 0.17–0.47 mm. long, 0.14–0.18 mm. wide, on the lower internodes represented only by small papillae, or more often entirely wanting: stipulodes forming

a single whorl at the upper nodes, probably exceeding the leaves in number, apparently early deciduous, ovate or oblong-ovate, when full-sized 3.5–8 mm. long, 0.8–0.9 mm. wide: leaves 9 or 10 in a whorl, about 6–10 cm. long, containing 3–5 internodes; leaflets somewhat unequal, 2–5 mm. long, 0.5–0.6 mm. wide: antheridia 0.36 mm. in diameter; immature sporocarps about 0.7 mm. long, 0.45 mm. wide; oöspores 0.45 mm. long, 0.38 mm. wide; whorl of crown-cells 0.17 mm. high, 0.22 mm. wide at the base, the individual cells ovate, shortly and obtusely beaked.

Type collected in Stafford County, Kansas, by M. A. Carleton, no. 302, July 11, 1891; in the herbarium of the New York Botanical Garden.

Distribution: Indiana to Iowa and Kansas.

A very distinct species, probably allied to *C. Hornemannii*, but at once distinguished by the absence of spine-cells from the mature internodes. In habit it greatly resembles *C. obtusa* Desv. = *Nitelopsis stelligera* (Bauer) Hy, or *Tolypellopsis stelligera* (Bauer) Mig., but lacks the starch-stars and is otherwise very different.

21. *Chara keukensis* (Allen)

C. gymnopitys keukensis [*Keukenis*] Allen, Bull. Torrey Club 20: 120. 1893.

Monoecious: 3.5–8 cm. high, well incrustated; stems 0.38–0.53 mm. in diameter, essentially triply corticated, the cortical node-cells forming secondary cortical cells on both sides, which usually however develop in only one longitudinal direction, or if in both, for a short distance only, narrow interstices sometimes occurring, the number of cortex rows in a cross-section thus being about twice the number of the leaves; spine-cells few, inconspicuous, when mature 0.45–0.9 mm. long, 0.05–0.1 mm. wide: stipulodes forming a single whorl at each node, twice the number of the leaves, 0.9–1.42 mm. long, 0.1–0.14 mm. wide, acute at the apex: leaves mostly 8 in a whorl, 5–8 mm. long, entirely uncorticated, containing 2–4 internodes; leaflets 5–8, those at sterile nodes 0.7–0.9 mm. long, 0.1–0.14 mm. wide, this often exceeding the diameter of the uppermost internodes of the leaves, as bracteoles much longer, sometimes exceeding 2 mm., surpassing the mature sporocarps: antheridia 0.25–0.28 mm. in diameter; mature sporocarps 0.6–0.65 mm. long, 0.33–0.4 mm. wide; oöspores oval, black, 0.44–0.49 mm. long, 0.28–0.33 mm. wide, with 9 somewhat faint striae; whorl of crown-cells 0.09–0.11 mm. high, 0.14–0.16 mm. wide at base, the individual cells ovate or nearly hemispheric, usually well separated at their tips.

Type locality: Lake Keuka, New York.

Distribution: Central New York and Welland County, Ontario, to western Lake Erie and southeastern Illinois.

Exsiccatae: Allen, Char. Am. Exsicc. 46.

22. *Chara mexicana* (Allen)

C. hydropitys mexicana Allen, Bull. Torrey Club 20: 120. 1893.

Monoecious: 7-12 cm. high, dark-green, slightly incrustated; stems 0.3-0.46 mm. in diameter, essentially triply corticated, secondary cortex-cells usually developing more or less on both sides of the primary, though usually very unequally in the two longitudinal directions, often quite irregular, when most regular appearing as if doubly corticated except opposite the cortical node-cells; spine-cells scattered, extremely variable, linear-lanceolate to ovate or triangular, 0.05-0.32 mm. long, 0.04-0.07 mm. wide, acute at the apex: stipulodes forming a single whorl at each node, twice the number of the leaves, 0.2-0.25 mm. long, 0.06 mm. wide, linear-lanceolate, acute or acuminate: leaves 9 or 10 in a whorl, 9-10 mm. long, composed of 5 or 6 internodes, of which the lowest one and the terminal one or two are uncorticated, and the 3 (rarely 4) intervening doubly corticated, the lowest internode 1.1-1.5 mm. long, 0.22-0.26 mm. wide, the succeeding corticated internode of nearly the same dimensions; leaflets at any node nearly equal, 0.66-0.86 mm. long, 0.09-0.12 mm. wide, linear-lanceolate, acute, as bracteoles about one and a half times as long as the mature sporocarps: antheridia 0.23-0.25 mm. in diameter; sporocarps 0.57-0.6 mm. long, 0.36-0.38 mm. wide; oöspores 0.4-0.42 mm. long, 0.24-0.27 mm. wide, with 10 striae; whorl of crown-cells short, 0.07-0.09 mm. high, 0.1-0.12 mm. wide at base, the individual cells ovate, ascending.

Type collected in a still pool of a mountain brook, north Mexico, by C. G. Pringle, November, 1886.

Distribution: Only known from original collection.

Exsiccatae: Allen, Char. Am. Exsicc. 45.

23. *Chara Liebmanni* sp. nov.

C. hydropitys perfecta A. Br. Fragm. Monogr. Char. 133. 1882.

Monoecious: similar in habit to the South American *C. hydropitys* Rchb., 12.5-18 cm. high; stems 0.4-0.42 mm. in diameter, the lowest nodes swollen, spherical, destitute of leaves, the cortex-cells little twisted, difficult to count, apparently very similar to those of the others of the group; spine-cells acute, about 0.05 mm. wide, the length of the longest lower ones greater than the diameter of the stem: stipulodes forming a single whorl, twice the number of the leaves, spreading, thicker than the spine-cells, similar to the leaflets: leaves mostly 10 in a whorl, usually containing 6 internodes, of which the lowest is uncorticated, 0.3 mm. thick and about

twice as long as the succeeding internodes, which are about the same length as one another, a little narrower than the uncorticated one, doubly corticated except the terminal one or sometimes two; leaflets 6-8 at all nodes, at the fertile 7 or 8, at the uppermost still 6, which are almost as long as the apical cell of the leaf, the lower ones somewhat shorter and narrower than the leaf-internodes, about twice as long as the sporocarps, not ventricose, wider than the spine-cells: antheridia 0.2-0.22 mm. in diameter; sporocarps somewhat oblong, about 0.6 mm. long, 0.36-0.38 mm. wide; oöspores black, 0.38-0.4 mm. long, 0.28-0.3 mm. wide.

Type locality: Potrero de Ponsoquitla, near Mirador, Mexico.

Distribution: Mexico to Lagoa Santa, Brazil, *fide* Braun.

24. *CHARA ROBBINSII* Halsted, Proc. Boston Soc. Nat. Hist. **20**: 183. 1879

C. hydropitys septentrionalis Nordst.; Allen, Char. Am. Exsicc. **10**. 1880.

C. hydropitys majuscula Nordst. in A. Br. Fragm. Monogr. Char. **134**, in part. 1882.

? *C. nudipes* Wallm. Kongl. Vet.-Akad. Handlingar **1852**: 293. 1854. If so, the oldest name.

Monococious: 9-18 cm. high, somewhat yellowish-green, slightly or moderately incrustated; stems 0.3-0.9 mm. in diameter, essentially triply corticated, secondary cortical cells developing on both sides of the primary, but usually extending in one direction for a very short distance and for nearly the whole length of the cortical internode in the other, the cortex thus being numerically double and so appearing if viewed casually; cortical cells usually long, spine-cells therefore distant, usually 0.6-1 mm. long, 0.09-0.1 mm. wide: stipulodes forming a single whorl at each node, twice as many as the leaves, 0.88-1.15 mm. long: leaves 11-13 in a whorl, 0.8-1.1 mm. long, the whorls distinct or somewhat overlapping at the apex, each leaf containing 6 or 7 internodes, the lowest internode of variable dimensions, 1-3 mm. long, 0.16-0.55 mm. wide, uncorticated, always wider, usually much so, than the succeeding ones, of which the next 2-5 are doubly corticated, leaving 1-3 uncorticated apical ones; leaflets of any whorl subequal, usually 1.2-1.5 mm. long, 0.11-0.16 mm. wide, about twice the length of the mature sporocarps, the terminal leaflets about two-thirds this length: antheridia 0.23-0.3 mm. in diameter; sporocarps 0.73-0.8 mm. long, 0.4-0.5 mm. wide; oöspores 0.48-0.53 mm. long, 0.3-0.38 mm. wide, with 10-12 striae; whorl of crown-cells 0.1-0.16 mm. high, 0.1-0.18 mm. wide at base, the individual cells ovate, somewhat erect or very widely spreading.

Type locality: Apponaug Pond, Rhode Island,

Distribution : Rhôde Island to New Jersey and Illinois.

Exsiccatae : Allen, Char. Am. Exsicc. 10.

The species as here conceived is somewhat polymorphic, the New Jersey plants being considerably more robust than those from Rhode Island and Connecticut. Agreement on the more essential characters seems however sufficiently close to warrant their union. Nordstedt identifies with this a plant from Vera Cruz, Mexico, which appears from the description to be somewhat different. Turckheim 606, Alta Vera Paz, Guatemala, is also somewhat closely allied, but too imperfect for accurate determination and description.

Chara Martiana Wallm. Kongl. Vet.-Akad. Handlingar 1852 : 294. 1854, would certainly be, from the description, a species of this group. Wallman published it supposing it to be *C. Martiana* A. Br., a dioecious species of the *gymnopus* group from South America, which, however, had not then been published, though casually mentioned. The name therefore belongs to Wallman's plant and Braun's must be renamed. Wallman's description is as follows :

"CH. MARTIANA: Caule subtilissime striato, striis rectis, in sicco collapsio, plano, inferne subnudo, superne aculeolato, aculeis sparsis, minutissimis, diametro caulis multo brevioribus; involucrio densissimo, spinulis uniseriatis, patentibus, acicularibus, caulis diametro longioribus; verticillis discretis, patenti-divaricatis, 10-12-radiatis; ramentis caule duplo augustioribus, 7-8-articulatis, geniculis constrictis, nodosis, obscurioribus, usque ad apicem bracteiferis; internodio basali proximis 2-3-plo breviori, monosiphonico, nudo, ceteris inordinate alternatim simpliciter et composite tubulosis; ramulis intercalariis brevissimis; bracteis angustissimis, cuspidatis, interioribus 4 : 2 longioribus, aequalibus, nuculam subaequantibus, 2 minoribus itidem aequalibus, nucula multo brevioribus, aversis abbreviatis, saepe obsoletis. Monoica.

"Ch. Martiusii *Al. Braun*, ined. — Ch. Martiana, idem Schweizer. Char.

"Amerika, Guatemala! Ifrån *Kegel* sänd till Apothekaren *Thedenius*, hvilken benäget meddelat densamma."

Nordstedt, however, has seen the original specimen, and says that the description is partially wrong; that the stipulodes form a double whorl, and that the plant really is *C. sejuncta*. It is not here cited as a synonym of that species, because two specimens from re-

lated regions, one from Mexico, the other from Colombia, while both too fragmentary for description, are yet clearly *sejunctae* in a wide sense, but if here described would be treated as distinct.

25. *CHARA HORNEMANNII* Wallm. Kongl. Vet.-Akad. Handlingar
1852: 288. 1854

C. ceratophylla Halsted, Proc. Boston Soc. Nat. Hist. 20: 182.
1879. Not *C. ceratophylla* Wallr.

Dioecious: 12-40 cm. high, somewhat yellowish- or dark-green, lightly incrustated; stems 0.7-1.5 mm. in diameter, essentially triply corticated, the cortical node-cells often developing secondary cells on both sides, but these usually elongating in one longitudinal direction only, the cortication thus appearing double, the primary cortex-cells somewhat larger and more prominent than the secondary; spine-cells very conspicuous, somewhat scattered on the lower parts of the stem, crowded near the apex, attaining a length of 8 mm., 0.3-0.55 mm. wide, obtuse, acute or acuminate at the apex: stipulodes forming a single whorl at each node, twice as many as the leaves or fewer, similar to the spine-cells, 2.5-10 mm. long, 0.35-0.7 mm. wide: leaves 8-10 in a whorl, 1-2.5 cm. long, usually containing 4 internodes, entirely uncorticated; leaflets 2-4 mm. long, 0.25-0.5 mm. wide, as bracteoles similar, much exceeding the sporocarps: antheridia 1-1.2 mm. in diameter; mature sporocarps 1-1.3 mm. long, 0.65-0.8 mm. wide; oöspores 0.56-0.8 mm. long, 0.4-0.48 mm. wide, with 5-7 striae; whorl of crown-cells about 0.175 mm. high, 0.2 mm. wide at base, ovate, the cells connivent.

Type locality: Crab Island, West Indies.

Distribution: Tropical and subtropical America from southern Florida and New Mexico through the West Indies and Mexico to southern Brazil.

Illustrations: Kütz. Tab. Phyc. 7: *pl.* 48. *f.* 1; A. Br. Fragm. Monogr. Char. *pl.* 2. *f.* 74; *pl.* 3. *f.* 75 (?).

26. *Chara Nordhoffiae* (Allen)

C. Hornemannii Nordhoffiae Allen, Bull. Torrey Club 27: 299.
pl. 12, 13. 1900.

Dioecious: closely allied to *C. Hornemannii* Wallm., but of somewhat different habit, owing to the longer internodes and more spreading leaves: 0.25-0.5 m. high, not incrustated; stems 1-1.5 mm. in diameter, cortex much as in *C. Hornemannii*, but the primary cortical cells distinctly more prominent than the secondary; spine-cells few on the lower internodes of the stem, more frequent but not crowded above, usually about 5 mm. long, but reaching a maximum length of 9 mm., 0.36-0.44 mm. wide: stipulodes forming

a single whorl at each node, mostly 6-9 mm. but becoming 12 mm. long, 0.44-0.53 mm. wide, about twice the number of the leaves, the latter reaching 8 cm. in length: antheridia 0.72-0.84 mm. in diameter; sporocarps 0.95-1.1 mm. long, 0.5-0.58 mm. wide; oöspores 0.6-0.72 mm. long, 0.32-0.44 mm. wide, with 5-7 prominent striae.

Type locality: Lakeside, San Diego County, California.

Distribution: Only known from type collection, and a species of very doubtful validity. Many of the measurements relied upon by Dr. Allen to separate it from *C. Hornemannii* were erroneous, and if further collections should show that the narrowness of the fruit is due to immaturity, it must be reduced to the status of a rather luxuriant form. The fruit of both species is insufficiently known and for that of *C. Hornemannii* Dr. Allen may have relied upon Braun's figure, which does not resemble any fruit on plants of this species in the herbarium of the New York Botanical Garden. Braun describes the oöspore of *C. Hornemannii* as 10-striate.

Illustrations: Bull. Torrey Club *loc. cit.*

Exsiccatae: Allen, Char. Am. Exsicc. *sine num.*

27. CHARA LEPTOSPERMA A. Br. Fragm. Monogr. Char. 184. *pl.*

4. *f.* 93-96. 1882

Monoecious: resembling in habit *C. fragilis brevifolia* A. Br., golden-green to occasionally dark-green, or greenish-brown, slightly incrustated, not very fragile; stems very slightly twisted, 0.45-0.5 mm. in diameter, or the lowest internodes attaining a maximum of 0.6-0.62 mm., triply corticated, 12-14 cells in a transverse section of the stem, primary and secondary cells equally wide and prominent, the secondary cells with horizontal terminal walls; spine-cells small but distinct, hemispheric: stipulodes forming a double whorl at each node, those in the lower whorl as long as the upper, 0.35-0.36 mm. long, about 0.06 mm. wide, less pointed than the leaflets: leaf-whorls distant, the leaves nearly upright, but slightly incurved, 7-9 in a whorl, about 1 cm. long, containing 6-7 doubly corticated internodes, of about equal length, 3 or 4 of them fertile, and an uncorticated conical terminal cell; leaflets present at all nodes, but at sterile nodes very short and inconspicuous, almost upright, papilla-like, moderately pointed, the two anterior the longer, as bracteoles the two anterior about the same length as the sporocarps, somewhat longer than the two lateral, moderately pointed, 0.08-0.11 mm. in width: antheridia about 0.25 mm. in diameter; sporocarps slender, 0.83-0.85 mm. long, 0.36-0.37 mm. wide; oöspores golden-brown and transparent, 0.55-0.6 mm. long, 0.3 mm. wide, with 11 or 12 striae; whorl of crown-cells 0.18-0.19 mm. high, and of equal width, the individual cells closely connivent.

Type locality : Between Morro and Rancho nuevo, Dept. Vera Cruz, Mexico.

Distribution : Mexico.

Illustrations : A. Br. *loc. cit.*

This form, of very doubtful specific value, is distinguished from *C. fragilis* by the golden, not black, oöspores, the more slender sporocarps, and by having well-developed stipulodes in spite of the short bracteoles.

28. *CHARA FRAGILIS* Desv.; Loisel. Not. Fl. France 137. 1810

C. vulgaris L. Sp. Pl. 1156, in part. 1753.

Monoecious : polymorphic, 2.5–75 cm. high, slightly or moderately incrustated, occasionally bearing bulblets; stems 0.35–0.85 mm. in diameter, very regularly triply corticated, the primary and secondary cortical cells nearly equally wide and prominent, usually comparatively narrow, cortical node-cells very small and inconspicuous, never bearing spine-cells and very rarely papillae : stipulodes greatly reduced and inconspicuous, forming a double whorl at each node, or more or less undeveloped : leaves 6–9 in a whorl, 4–30 mm. long, containing 5–8 doubly corticated internodes, and an uncorticated 1- or 2-celled tip; the posterior and sometimes all the leaflets at the sterile nodes wanting, the anterior however often present though short, rarely 0.4 mm. long, as bracteoles only one or two on each side of the oögonium developed, when two the anterior the longer, much shorter than or exceeding the mature sporocarp : antheridia 0.3–0.4 mm. in diameter; sporocarps 0.78–1.1 mm. long, 0.45–0.63 mm. wide; oöspores black, 0.58–0.72 mm. long, 0.36–0.48 mm. wide, with 10–14 striae; whorl of crown-cells 0.14–0.2 mm. high, 0.17–0.25 mm. wide at base, the individual cells oblong, usually truncate at the apex, usually erect and connivent.

Type locality : Paris, France.

Distribution : Canada, United States and Mexico, but apparently not in the West Indies; cosmopolitan.

Illustrations : Kütz. Tab. Phyc. 7 : *pl.* 54, 55; Flora Danica 16 : *pl.* 2796, 2797; Jour. Bot. 18 : *pl.* 207, *f.* 1; Migula, Char. Deutsch. Oesterr. Schw. *f.* 146, 147; Migula, Consp. Char. Eur. *f.* 131, 132; J. E. Smith, Eng. Bot. Supp. 2 : *pl.* 2762; Ganterer, Oesterr. Char. *pl.* 2. *f.* 15, 16; Oltmanns, Morph. Biol. Alg. *pl.* 207; Woods, Flor. Neb. 1 : *pl.* 35; E. & P. Natürl. Pflanzenfam. 1² : *pl.* 109.

Exsiccatae : Allen, Char. Am. Exsicc. 21; Collins, Holden & Setchell, Phyc. Bor. Am. 1198.

Migula, Groves and others, cite among the synonyms of this

species *C. globularis* Thuill. Flore Env. Paris. ed. 2. 472. 1799, and *C. capillacea* Thuill. *loc. cit.* 1799. From the descriptions it seems very probable that both are forms with abnormal sporocarps. If one or both are identical with *C. fragilis* the latter name must be replaced, but without absolute certainty it is here considered inadvisable to make any change in what is perhaps the longest-established and most widely accepted specific name in the genus.

29. CHARA VERRUCOSA Itzigsohn, Bot. Zeit. 8: 338. 1850

C. delicatula Ag. Syst. Alg. 130. 1824. Not *C. delicatula* Desv. 1810.

C. fragilis delicatula von Leonh. Oesterr. Arml.-Gew. 90. 1864.

Monoecious: 5–30 cm. high, rather slightly incrusting; stems 0.33–0.53 mm. in diameter, regularly triply corticated, the primary cortical cells clearly of greater diameter than the secondary cells, and projecting somewhat beyond them, the secondary cells occasionally somewhat irregular, sometimes leaving only a single secondary cell between two primaries; cortical node-cells sufficiently conspicuous, usually forming papillae, rarely becoming short spine-cells: at least the stipulodes of the upper whorl well developed, 0.12–0.42 mm. long, those in the lower nearly always shorter, usually 0.09–0.18 mm. long, sometimes very inconspicuous: leaves 7 or 8 in a whorl, 4–21 mm. long, containing 3–9, much most frequently 8 or 9, doubly corticated internodes, and a 1–3-celled uncorticated apex; posterior leaflets undeveloped, or reduced to mere papillae, the anterior at sterile nodes 0.1–0.44 mm. long or hardly developed, as bracteoles variable, 0.28–1.4 mm. long, more often exceeding the mature sporocarps: antheridia 0.35–0.56 mm. in diameter; sporocarps 0.9–1.12 mm. long, 0.52–0.7 mm. wide; oöspores 0.63–0.8 mm. long, 0.47–0.6 mm. wide, with 11–13 striae; whorl of crown-cells 0.1–0.24 mm. high, 0.18–0.26 mm. wide, the individual cells oblong-lanceolate to ovate, mostly connivent.

Type locality: Germany.

Distribution: Maine and New York to Alaska and California; Europe.

Illustrations: Jour. Bot. 18: *pl.* 207. *f.* 1a; A. Br. Fragm. Monogr. Char. *pl.* 7. *f.* 269, 270; Migula, Char. Deutsch. Oesterr. Schw. *f.* 148; Migula, Consp. Char. Eur. *f.* 133; Fl. Dan. 16: *pl.* 2798.

Exsiccatae: Allen, Char. Am. Exsicc. 22; Collins, Holden & Setchell, Phyc. Bor. Am. 1199. The latter plant, from California, diverges considerably from typical material, the former contains some *C. aspera*.

30. *CHARA ASPERA* Willd. Ges. Naturf. Fr. Berlin Mag. 3 :
298. 1809

C. aspera nitidula A. Br. Fragm. Monogr. Char. 175. 1882.

Dioecious: 10–18 cm. high, dull- or pale-green, very slightly incrustated, bulblets often present; stems 0.33–0.45 mm. in diameter, triply corticated, but the secondary cells often developed in one longitudinal direction only, or for short distances only in either or both directions, the stems thus numerically about doubly corticated; spine-cells variable, linear to ovate, 0.12–0.9 mm. long: stipulodes forming a double whorl at each node, medium in length, those in the upper whorl somewhat the longer, 0.27–0.66 mm. long, 0.05–0.1 mm. wide: leaves 7–10 in a whorl, 6–15 mm. long, containing 5–7 doubly corticated internodes, with an extremely variable 1- or 2-celled uncorticated tip, this last acute to square-cornered at the apex; all leaflets at any node developed, but the anterior the longer, at sterile nodes usually 0.35–0.52 mm. long, but at young nodes sometimes less, the posterior usually one-half to one-third this length; lateral bracteoles almost always exceeding the antheridia and probably the oögonia, usually 0.63–0.96 mm. long, rarely less: antheridia 0.4–0.57 mm. in diameter; only immature sporocarps seen on American material, but according to Migula and Allen, when mature 0.75–0.9 mm. long, 0.4–0.55 mm. wide; oöspores 0.44–0.65 mm. long, 0.28–0.4 mm. wide, with 11–16 striae; whorl of crown-cells according to Migula 0.08 mm. high, 0.14 mm. wide at base, but in the immature American sporocarps 0.14 mm. high, 0.16–0.18 mm. wide at base, the individual cells lanceolate, ascending.

Type locality: Warnemünde, Mecklenburg-Schwerin, Germany.

Distribution: Newfoundland to Long Island, also New Mexico; also Europe and N. W. Africa. The New Mexican plants are rather different from northern ones, but themselves vary, and are better not separated at present.

Illustrations: Bull. Torrey Club 9: *pl.* 21, *f.* A, 1–3, 7; Kütz. Phyc. Tab. 7: *pl.* 52, *f.* 1; Jour. Bot. 18: *pl.* 207, *f.* 4; Migula, Char. Deutsch. Oesterr. Schw. *pl.* 134, 135; Migula, Consp. Char. Eur. *f.* 119, 120; Grev. Crypt. Fl. 6: *pl.* 339.

Exsiccatae: Collins, Holden, & Setchell, Phyc. Bor. Am. 1196.

31. *Chara Macounii* Allen, in herb.

C. aspera Macounii Allen, Bull. Torrey Club 9: 44. *pl.* 21, *f.* B, 4–6. 1882.

Dioecious, or in extremely rare cases antheridia and oögonia on different nodes of the same leaf: 5–10 cm. high, dull-green, slightly incrustated, bulblets often present; stems 0.25–0.44 mm. in diameter, corticated as in *C. aspera*, but the spine-cells reduced to papillae,

0.04–0.11 mm. or very rarely 0.18 mm. long: stipulodes also reduced, ovate or oblong, those in the upper whorl usually 0.09–0.16 mm. long, rarely either more or less than this, those in the lower whorl 0.05–0.14 mm. long: leaves 6–8 in a whorl, 0.7–1.4 mm. long, the lower 3–8, usually 6 or 7, internodes doubly corticated, the uncorticated tip 1–3-celled; posterior leaflets reduced to mere papillae, 0.035–0.085 mm. long, the anterior 0.09–0.26 mm. long, in both cases rarely near the upper limit given, as bracteoles in male plants the anterior 0.18–0.32 mm. long, or about one-half the diameter of the antheridia except when the latter are very young, on female plants the anterior bracteoles 0.42–0.7 mm. long, slightly exceeding or shorter than the probably immature sporocarps: antheridia seen up to 0.62 mm. in diameter; most nearly mature sporocarp 0.7 mm. long, 0.45 mm. wide, its oöspore 0.42 mm. long, 0.35 mm. wide, striae probably 8–10; whorl of crown-cells 0.1–0.12 mm. high, 0.2 mm. wide at base, the individual cells ovate-globose, not closely connivent.

Type collected by John Macoun, *no. 16*, at Long Lake, Saskatchewan, July 8, 1879; in the herbarium of the New York Botanical Garden.

Distribution: Vermont to Saskatchewan.

Illustrations: Bull. Torrey Club *loc. cit.*

Exsiccatae: Allen, Char. Am. Exsicc. 27.

Originally considered a distinct species by Dr. Allen, but he was persuaded to reduce it to a variety of *C. aspera*, which is its nearest ally. It seems to be distinct, however, by having shorter stipulodes, by the reduction of the spines to papillae, by the similar reduction of the posterior leaflets, and by shorter bracteoles. Probably also the striae upon the oöspore are fewer than in any form of genuine *C. aspera*.

32. *CHARA CUBENSIS* Allen, Bull. Torrey Club 21: 163. *pl. 189*.
1894

Monoecious, the antheridia and oögonia borne upon the same leaf-nodes, the lowest rarely on that between the uncorticated basal and the lowest of the corticated internodes, usually on the node between the two lowest corticated internodes: rather pale-green, 0.4–0.5 m. high, slightly incrustated; stems 0.6–0.84 mm. in diameter, triply corticated; spine-cells 0.2–0.9 mm. long, but inconspicuous, linear, acute: stipulodes forming a double whorl at each node, those in the upper whorl 0.84–0.96 mm. long, very nearly equaling the length of the uncorticated basal leaf-internode, stipulodes of lower whorl 0.52–0.6 mm. long: leaves 12–15 in a whorl, 2–3 cm. long, containing 6–9 internodes, the basal one uncorticated, the next two or sometimes three triply corticated, the remainder uncorticated, or

more rarely the leaves entirely uncorticated, the uncorticated basal-leaf internode 0.9–1.15 mm. long, 0.34–0.55 mm. wide, the succeeding corticated internodes approximately 2.5 mm. long, and the uncorticated ones, except the last, 5–6.5 mm. long; leaflets at sterile nodes usually slightly unequal, 0.4–1.1 mm. long, as bracteoles the anterior and lateral usually the longer, 1–1.4 mm. long, the posterior 0.88–1 mm. long, all exceeding the sporocarps: antheridia 0.3–0.36 mm. in diameter; only immature sporocarps on type material, the best developed of these 0.6–0.68 mm. long, 0.38–0.44 mm. wide, with oöspores 0.42–0.46 mm. long, 0.35–0.4 mm. wide, said by Allen to be 0.6 mm. long; striae inconspicuous, 12–14; whorl of crown-cells 0.12–0.16 mm. high, 0.17–0.21 mm. wide at base, the individual cells lanceolate, rounded at the apex, widely spreading.

Type locality; Guaiman (?), Cuba.

Distribution: Cuba.

Illustration: Bull. Torrey Club *loc. cit.*

Placed by Allen with either *C. foliolosa* or *C. zeylanica*, but it is evidently near and possibly too near *C. inconstans*.

33. *Chara elegans* (A. Br.)

C. gymnopus elegans A. Br.; Allen (Bull. Torrey Club 2: 10. 1871; hyponym), Char. Am. *pl.* 1. 1879.

Monoecious, the antheridia and oögonia at the same leaf-nodes, the lowest occurring on the node between the uncorticated basal and the lowest of the corticated internodes of the leaf: 15–25 cm. high, light-green, only moderately incrustated; stems 0.6–0.9 mm. in diameter, triply corticated, the primary cortical cells often broader than the secondary, comparatively short, 0.55–0.6 mm. long when full length, adjacent ones nearly of equal length, so that the spine-cells borne at the cortical node-cells appear to form whorls around the stem, about ten such whorls in each internode; spine-cells 1–1.6 mm. long, 0.1–0.12 mm. wide at the base: stipulodes forming a double whorl at each node, those in the upper whorl reaching a length of over 1.8 mm., exceeding in length the uncorticated basal internode of the leaves, stipulodes of lower whorl 0.9 mm. long: leaves 9–12 in a whorl, 1.4–1.8 cm. long, containing 7–9 internodes, all triply corticated, except the basal internode, and one or more at the apex, which are uncorticated; basal uncorticated internode about 0.7 mm. long; leaflets at sterile nodes nearly equal, 0.5–1.3 mm. long, as bracteoles the anterior 0.8–2.3 mm. long, the posterior usually a little less, 0.77–1.5 mm. long, always exceeding and usually much exceeding the mature sporocarps: antheridia about 0.5 mm. in diameter; sporocarps of variable size, dimensions given by Allen 0.6–0.75 mm. long, 0.4–0.5 mm. wide, but apparently nearly always larger, 0.84–1.27 mm. long, 0.43–0.75 mm. wide;

oöspores 0.56–0.8 mm. long, 0.38–0.5 mm. wide, with 12–15 striae; whorl of crown-cells 0.21–0.23 mm. high, 0.21–0.25 mm. wide at base, the individual cells lanceolate, their apices obtuse, usually widely separated.

Type locality: Peekskill, New York.

Distribution: Essex County, Massachusetts, to Lakes Champlain and Saratoga and the Hudson River.

Illustrations: Allen, Char. Am. *pl.* 1. 1879; *pl.* 1. 1880; Bull. Torrey Club 27: *pl.* 15. *f.* 5.

Exsiccatae: Allen, Char. Am. Exsicc. 23.

A plant from New Haven, Connecticut, agrees with this in practically every character, except that the dimensions are smaller with hardly an exception. Considerable variations in size are therefore to be expected.

34. CHARA INCONSTANS A. Br.; Kütz. Tab. Phyc. 7: 28. *pl.* 70. *f.* 2. 1857

C. (inconstans) Oerstediana A. Br. Monatsber. Königl. Akad. Wissensch. Berlin 1858: 367. 1858.

C. Crügeriana A. Br. Monatsber. Königl. Akad. Wissensch. Berlin 1858: 368. 1858.

C. Oerstediana A. Br.; Allen, Char. Am. 3. 1880.

C. gymnopus inconstans f. Örstediana A. Br. Fragm. Monogr. Char. 193. 1882.

C. gymnopus inconstans f. Crügeriana A. Br. Fragm. Monogr. Char. 193. 1882.

C. gymnopus inconstans A. Br.; Allen, Publ. Bot. Field Columb. Mus. 1: 286. 1896.

C. zeylanica inconstans H. & J. Groves, Jour. Linn. Soc. 33: 323. 1898.

Monoecious, the antheridia and oögonia borne together upon the three lowest leaf-nodes: 4.5–15 cm. high, ashen or pale-green, or ferruginous-ochraceous below; stems 0.6–0.75 mm. in diameter, triply corticated; spine-cells variable, 0.07–0.8 mm. long, acutish: stipulodes forming a double whorl at each node, those in the upper whorl 0.4–0.9 mm. long, nearly always shorter than the uncorticated basal internode of the leaves, stipulodes of lower whorl 0.28–0.68 mm. long: leaves 9–12 in a whorl, 5–15 mm. long, containing 5–7 internodes besides the apical cell, of which the lowest one is uncorticated, the next 1–3 triply corticated, and the remainder uncorticated, or the leaves of the lowest whorls entirely uncorticated; uncorticated basal internode 0.56–0.9 mm. long, or 2–6 times as long as broad, nearly equaling or shorter than the lowest of the

corticated internodes, the latter usually about 1 mm. long; leaflets at sterile nodes 0.18–1.25 mm. long, according to Braun the anterior the longer, in the specimens examined almost of equal length, as bracteoles the anterior pair the longest, twice as long as or rarely only slightly exceeding the sporocarps, the others as long as or shorter than the sporocarps: antheridia 0.25–0.35 mm. in diameter; sporocarps 0.63–0.85 mm. long, 0.36–0.4 mm. wide; oöspores 0.48–0.6 mm. long, 0.28–0.3 mm. wide; striae on entire side of sporocarp 14–15; crown-cells elongated, cylindrical, or shorter, erect or diverging.

Type locality: Trinidad, West Indies.

Distribution: Trinidad and Central America.

Illustration: Kütz. Tab. Phyc. *loc. cit.*

Following Braun, the Trinidad and Nicaraguan plants are placed together. Some of the measurements are from plants collected by Wright in Lake Nicaragua, certainly *Oerstediana*, and by Gaumer in Yucatan, which are nearer to *Crügeriana*. Additional mature material must be collected before the true status is finally determined.

35. *Chara filicaulis* sp. nov.

Monoecious, the antheridia and oögonia borne together upon the leaf-internodes, including that between the uncorticated basal and the lowest of the corticated leaf-internodes: probably 0.4–0.5 m. high, bright-green or the older internodes becoming grayish, very slightly incrustated; stems 0.4–0.52 mm. in diameter, ultimately triply corticated, but the secondary cells developing irregularly, so that the youngest internodes often seem doubly corticated, or rarely two primary cells are not separated by secondary ones; or on the contrary, by the ends of two secondaries from consecutive cortical nodes slipping past one another, three secondary cells may intervene between two primaries; apical stem-internodes short, beset with spine-cells 0.88–1.25 mm. or even 1.5 mm. long, 0.04–0.09 mm. wide, older internodes becoming 5–10 cm. long, with scattered spine-cells: stipulodes forming a double whorl at each node, those in the upper whorl 0.7–0.88 mm. long, 0.07–0.09 mm. wide, $1\frac{1}{3}$ times as long as the uncorticated basal leaf-internodes, stipulodes of lower whorl 0.52–0.6 mm. long: leaves 8–10 in a whorl, 1.2–1.8 cm. long, containing 8–10 internodes, all triply corticated except the basal one and the terminal cell, uncorticated basal internode 0.44–0.7 mm. long, 0.2–0.25 mm. wide; leaflets at sterile nodes 0.17–0.45 mm. long, the anterior usually distinctly longer than the posterior, as bracteoles the anterior 0.85–1.25 mm. long, slightly exceeding the sporocarps, posterior bracteoles 0.19–0.23 mm. long: antheridia rather early deciduous, 0.37–0.42 mm. in diameter; sporocarps 0.84–0.95 mm. long, 0.37–0.47 mm. wide; oöspores 0.63–0.75 mm. long, 0.32–0.42 mm. wide, with 12–14 striae; whorl of crown-cells 0.11–0.14 mm.

high, 0.15–0.17 mm. wide at base, the individual cells lanceolate, somewhat erect or more often widely spreading.

Type collected in the Everglades, Florida, by A. H. Curtiss, February, 1882; in the herbarium of the New York Botanical Garden.

Distribution : Only known from original collection.

36. *Chara fertilissima* (A. Br.)

C. gymnopus fertilissima A. Br. Fragm. Monogr. Char. 192. 1882.

Monoecious, the antheridia and oogonia borne upon the same leaf-nodes, including that between the uncorticated basal and the lowest of the corticated leaf-internodes : of medium size, golden to green in color, collapsing when dry, brittle; stems triply corticated; spine-cells visible only on the upper whorls, often decidedly whorled, usually small and acute, occasionally longer : stipulodes forming a double whorl at each node, those in the upper whorl covering the uncorticated basal internode of the leaves : leaves 12 or 13 in a whorl, the uncorticated basal internode succeeded by 4–6 triply corticated, and these by 1–3 uncorticated internodes, the uncorticated basal internode about twice as long as wide; fertile leaf-nodes with about 3 posterior, short, or even very short bracteoles, and 4–6 elongated ones, the pair most anterior the longest, usually longer than, often twice as long as the sporocarps, very acute, 0.08–0.09 mm. wide : sporocarps slender, 0.87–0.92 mm. long, 0.38–0.43 mm. wide, with 14 striae; oöspores 0.6–0.65 mm. long, 0.3–0.34 mm. wide, black, the striae barely visible; crown-cells short, erect.

Type locality : Martinique.

Distribution : Only known from original collection.

37. *Chara guatemalensis* (Nordst.)

C. gymnopus guatemalensis Nordst. Hedwigia 27 : 193. 1888.

Monoecious, the antheridia and oogonia borne together upon the 2 or 3 lowest leaf-nodes : about 30 cm. high, golden-green, somewhat glistening, not incrustated; stem about 0.5 mm. in diameter, triply corticated; spine-cells very short, acute : stipulodes acute, about 0.1 mm. in diameter, forming a double whorl at each node, those in the upper somewhat longer than those in the lower, but not, or only at the youngest nodes, covering the uncorticated basal internode of the leaves : leaf-whorls separate, composed of about 10 leaves, 1–2 cm. long, with 6–8 internodes, entirely uncorticated, lowest internode about 3–4 times as long as wide, nearly equaling the succeeding ones, the second no longer than the third, terminal cell short, acute; leaflets 0.075–0.1 mm. in diameter, acute, at fertile nodes 7, the 3 posterior short, somewhat projecting, the 2 lateral

almost as long as the sporocarp or somewhat shorter, the anterior usually somewhat longer, leaflets at sterile nodes shorter : antheridia 0.5 mm. in diameter ; sporocarps 1 mm. long ; oöspores 0.62 mm. long, 0.42-0.45 mm. wide ; crown-cells 0.2 mm. high, often conic-cylindric, sometimes still shorter.

Type collected at Laguna de Ysabal, Guatemala, by G. Bernoulli, *no.* 879, August, 1870.

Distribution : Guatemala, Honduras.

38. *CHARA CARMENENSIS* Allen, Bull. Torrey Club **21** : 164. *pl.* 190. 1894

Monoecious, the antheridia and oögonia borne upon the same leaf-nodes, including that between the uncorticated basal and the lowest of the corticated leaf-internodes : about 25 cm. high, light-green, very slightly incrustated ; stem 0.5-0.7 mm. in diameter, triply corticated, spine-cells slender, 0.1-0.82 mm. long, or less often reduced to small papillae : stipulodes forming a double whorl at each node, those in the upper whorl 0.66-0.88 mm. long, considerably shorter than the uncorticated basal leaf-internodes, stipulodes of lower whorl 0.38-0.52 mm. long : leaves 8-10 in a whorl, 1.5-2 cm. long, containing 7-9 internodes, of which the lowest one, the apical cell, and the internode next below it are always or nearly always uncorticated, the remaining internodes triply corticated, uncorticated basal internode 1.05-1.7 mm. long, 0.25-0.45 mm. wide ; leaflets at sterile nodes about equal, 0.12-0.42 mm. long, as bracteoles the anterior 0.8-1.15 mm. long, exceeding the sporocarps, posterior bracteoles 0.12-0.35 mm. long : antheridia 0.3-0.4 mm. in diameter ; sporocarps 0.8-0.92 mm. long, 0.42-0.46 mm. wide ; oöspores 0.52-0.6 mm. long, 0.33-0.39 mm. wide, with 11 or 12 very prominent striae ; whorl of crown-cells 0.1-0.16 mm. high, 0.16-0.21 mm. wide at base, the individual cells lanceolate, rounded or almost truncate at the apex, erect but not connivent.

Type locality : Carmen Island, Gulf of California, Mexico.

Distribution : Only known from original collection.

Illustration : Bull. Torrey Club *loc. cit.*

39. *CHARA HICKSII* Allen, Bull. Torrey Club **21** : *pl.* 191. 1894
C. inconstans Hicksiana Allen, *loc. cit.* 164.

Monoecious, the antheridia and archegonia borne upon the same leaf-nodes, occurring at the node between the uncorticated basal and lowest corticated internodes : about 4 cm. high, cespitose, grayish in color, proportionately heavily incrustated, resembling *C. keukensis* in habit ; stems 0.5-0.66 mm. in diameter, cortication in most parts very regularly triple, but at intervals becoming irregular, secondary cortical cells failing to develop, or primary cells running

diagonally across the stem, or interstices being left, or the ends of two secondary cells well overlapping, primary cortical rows being adjacent, or separated by one, two, or three secondary cortical cells; spine-cells rather numerous, 0.1–0.4 mm. long: stipulodes forming a double whorl at each node, those in the upper whorl 0.58–0.72 mm. long, rarely equaling, usually much shorter than the uncorticated basal internode of the leaves, especially at the lower nodes of the stem, stipulodes of lower whorl 0.32–0.4 mm. long: leaves about 10 in a whorl, 4–8 mm. long, containing 5–7 internodes, which are triply corticated except the basal one and rarely the apical one, which are uncorticated, as is also the 1–3-celled leaf-tip, length of uncorticated basal internode 0.7–1.8 mm., when mature 2–5 times as long as broad; leaflets at sterile nodes nearly equal, 0.22–0.33 mm. long, as bracteoles the anterior much the longer, 0.6–0.92 mm. long, as a rule slightly exceeding the sporocarps, but often shorter than them, posterior bracteoles 0.26–0.37 mm. long, the lateral intermediate in length: antheridia 0.32–0.46 mm. in diameter; sporocarps 0.8–0.9 mm. long, 0.5–0.58 mm. wide; oöspores 0.54–0.65 mm. long, 0.33–0.37 mm. wide, with 12–14 striae; whorl of crown-cells 0.09–0.1 mm. high, 0.14–0.18 mm. wide at base, the individual cells ovate, rounded at the apex, diverging.

Type locality: Munith, Jackson County, Michigan.

Distribution: Only known from original collection.^{7,1}

Illustration: Bull. Torrey Club *loc. cit.*

40. *Chara stellata* sp. nov.

Monoecious, the antheridia and oögonia borne together upon the three lowest leaf-nodes: probably about 25 cm. high, dark-green, very lightly incrustated; stems 0.52–0.63 mm. in diameter, triply corticated; spine-cells somewhat rigid, spreading, 0.3–1.6 mm. long, 0.05–0.11 mm. wide, but the great majority 0.7–1.2 mm. long, 0.07 mm. wide, of almost unchanging diameter except near the subacute apex: stipulodes forming a double whorl at each node, those in each whorl normally twice the number of the leaves, or some in either aborting, though this is most unlikely to be a constant character, those in the upper whorl 0.85–1.3 mm. long, much exceeding but not concealing the uncorticated basal leaf-internodes; stipulodes of lower whorl 0.4–0.68 mm. long: leaves 7–9 in a whorl, about 1 cm. long, containing 7–10 internodes, triply corticated, except the basal one, the apical cell, and usually the internode below the apical cell, which are uncorticated; uncorticated basal leaf-internode usually 0.44–0.54 mm. long, 0.35–0.44 mm. wide; usually 4 or 5 leaflets developed at sterile but 8 or 9 at fertile nodes, those at the sterile nodes 0.6–1.1 mm. long, those at a single node of nearly the same length, at the fertile nodes the anterior pair 1–1.5 mm. long, exceeding the rest, which are nearly equal, the pos-

terior hardly reduced, 0.6–1.1 mm. long, all usually exceeding the sporocarps: antheridia very early deciduous, none seen with a greater diameter than 0.27 mm.; sporocarps 0.75–0.88 mm. long, 0.4–0.46 mm. wide, with 10 or 11 light striae; whorl of crown-cells 0.09–0.11 mm. high, 0.16–0.18 mm. wide at base, seen as a whole appearing nearly flat-topped, the individual cells globose-ovate, connivent or sometimes spreading.

Type collected by Edward Palmer, *no.* 705, at Durango, Mexico, April to November, 1896; in the herbarium of the New York Botanical Garden.

Distribution: Only known from original collection.

A plant with much the habit of *C. Sanctae-Margaritae*, but approaching in some ways even more closely to *C. elegans*.

41. *Chara Sanctae-Margaritae* (Allen)

C. gymnopus Sanctae-Margaritae Allen, Bull. Torrey Club 27: 303. *pl.* 14; 15, *f.* 1–4. 1900.

Monoeocious, the antheridia and oögonia borne upon the same leaf-nodes: 0.1–1 m. high, light-green, moderately but often unequally incrustated; stems 0.6–1 mm. in diameter, triply corticated, the terminal internodes beset with, the lower ones less so or nearly destitute of, spine-cells, the length of the latter usually 0.7–1 mm.: stipulodes forming a double whorl at each node, those in the upper linear, acute, about 0.7 mm. long, 0.125 mm. wide, usually nearly twice the length of the uncorticated basal internode of the leaves, stipulodes of the lower whorl of similar width, but only 0.35–0.45 mm. long: leaves 10–12 in a whorl, 1–1.5 mm. long, containing 8–10 internodes, all triply corticated except the basal one, and the terminal one, or sometimes two, which are uncorticated; leaflets at all nodes well developed, 0.3–0.82 mm. long, those at any node the same size or more often the anterior the longer, similar as bracteoles, the anterior 0.96–1.2 mm. long, exceeding the sporocarps, usually slightly, but sometimes one and a half times their length, posterior bracteoles 0.3–0.6 mm. long: antheridia about 0.35 mm. in diameter, often early deciduous; sporocarps 0.8–1 mm. long and 0.4–0.44 mm. wide, oöspores 0.63–0.68 mm. long, 0.28–0.34 mm. wide, with 13 or 14 striae; whorl of crown-cells 0.14–0.2 mm. high, 0.16–0.2 mm. wide at base, the individual cells lanceolate-ovate, rounded at the apex, ascending.

Type locality: Lakeside, San Diego County, California.

Distribution: Central and southern California.

Illustration: Bull. Torrey Club *loc. cit.*

42. CHARA FOLIOLOSA Muhl.; Willd. Mém. Acad. Roy. Berlin
1803: (Cl. Phil. Exper.) 86. *pl. 1. f. 2.* 1805

C. foliosa Pers. Syn. Pl. 2: 530. 1807.

? *C. compressa* Kunth; H.B.K. Nov. Gen. 1: 45. 1815.

? *C. polyphylla Humboldtiana* A. Br. Boston Jour. Nat. Hist. 5:
264. 1845.

C. polyphylla Muhlenbergii A. Br. Boston Jour. Nat. Hist. 5:
264. 1845.

C. polyphylla minor Kütz. Sp. Alg. 522. 1849.

? *C. polyphylla Humboldtii* Kütz. Sp. Alg. 522. 1849.

C. Wikströmii Wallm. Kongl. Vet.-Akad. Handlingar 1852: 297.
1854.

C. (polyphylla) Humboldtii A. Br. Monatsber. Konigl. Akad.
Wissensch. Berlin 1858: 360. 1858.

C. gymnopus Humboldtii A. Br.; Allen, Char. Am. 2. 1880.

C. depauperata Allen, Bull. Torrey Club 21: 167. *pl. 192.* 1894.

Monoecious, the antheridia and oögonia occurring at the same leaf-nodes: 15–60 cm. high, lightly or moderately incrustated; stems 0.6–1.2 mm. in diameter, triply corticated; spine-cells often numerous on the youngest internodes, very scattered on older ones, extremely variable even on a single internode, ranging from mere papillae to slender cells nearly 2 mm. long: stipulodes forming a double whorl at each node, those in the upper whorl 0.56–1.3 mm., most frequently 0.7–0.8 mm. long, usually exceeding but not concealing the uncorticated basal internodes of the leaves; stipulodes of lower whorl 0.32–0.84 mm. long, from one-half to three-fourths the length of the corresponding stipulode of the upper whorl: leaves 10–15 in a whorl, 12–35 cm. long, containing 10–20 internodes, the latter when mature triply corticated, except always the basal one, and rarely one or more at the apex, which are uncorticated; young leaves said to be sometimes entirely uncorticated; the uncorticated basal internode 0.4–1 mm. long, and of equal or slightly less diameter; leaflets at any sterile node subequal, 0.17–0.55 mm. long, those at the node between the uncorticated basal and the lowest of the corticated internodes similar to the rest, as bracteoles the anterior 0.7–1.55 mm. long, usually shorter than but sometimes a little exceeding the sporocarps, the posterior much shorter but still well developed, 0.14–0.33 mm. long: antheridia 0.38–0.56 mm. in diameter; sporocarps 0.9–1.2 mm. long, 0.5–0.67 mm. wide; oöspores 0.68–0.78 mm. long, 0.4–0.5 mm. wide, with 11–15 striae; whorl of crown-cells 0.15–0.19 mm. high, 0.21–0.23 mm. wide at base, the individual cells lanceolate, nearly erect but not connivent.

Type locality: Pennsylvania.

Distribution: Pennsylvania to South America.

Illustrations: Mém. Acad. Roy. Berlin *loc. cit.*; Kütz. Phyc. Tab. 7: *pl.* 77, *f.* 1 (*C. compressa*); Bull. Torrey Club 21: *pl.* 192 (*C. depauperata*, a very abnormal condition).

Exsiccatae: Allen, Char. Am. Exsicc. 24.

Sometimes very luxuriant forms occur which seem referable to this species, though the vegetative organs have dimensions much in excess of the maximum figures given above. Those so seen were not in mature fruit, and exact determination was impossible.

This was the first species of the *gymnopus* group to be described, making its appearance in 1805, simultaneously with, but placed before *C. zeylanica* Willd. As *C. compressa* (the identity is very probable, but not quite certain), it was again described in 1815. *C. haitensis* appeared in 1826, *C. indica* in 1827, *C. verticillata* in 1832, *C. armata* and *C. polyphylla* in 1835. No species of the group has ever been found in Europe, but as the other continents were explored botanically each yielded new forms, all closely allied, but still a little different. At first Braun believed that they could be kept specifically distinct, but by 1844 he changed his views and ranked them as subspecies, choosing as the specific name *C. polyphylla*, which thus in his hands temporarily acquired a wider meaning, only to drop out of nomenclature altogether, except as a synonym. In 1847, casual reference is made by Braun to a *C. gymnopus*, in 1849 this is located as Egyptian, but no description appeared before 1868, when the name was published with a double sense. First the Egyptian plant is given this name and then reduced in a note to varietal rank, and *Chara gymnopus* extended to cover all triply corticated plants having the lowest leaf-internodes uncorticated. If any regard at all is given to priority of publication, *C. gymnopus* is antedated by 63 years, and numerous names. Yet H. and J. Groves seem to be the only writers who do not use it to-day, their choice being *C. zeylanica*. If, as here, the units are considered to be species, much of the nomenclatural difficulty vanishes.

Allen, at first following Braun, accepted all forms as varieties of *C. gymnopus*, later he emphatically asserted their specific rank, finally he seems to have reverted to his original position.

43. CHARA HAITENSIS Turpin, Dict. Sci. Nat. Veg. Acot. *pl.* 101. (Livr. 40: *pl.* 1). 1826

C. polyphylla A. Br. Flora 18: 70. 1835.

C. Michauxii A. Br. Am. Jour. Sci. 46: 93. 1844.

C. polyphylla Michauxii A. Br. Boston Jour. Nat. Hist. 5: 264. 1845.

C. (polyphylla) Michauxii A. Br. Monatsber. K. Akad. Wissensch. Berlin 1858: 362. 1858.

C. gymnopus Michauxii A. Br.; Allen, Char. Am. 2. 1880.

C. polyphylla A. Br. Am. Jour. Sci. 46: 93. 1844; and subsequent publications before 1868, in part only.

Monoecious, the antheridia and oögonia borne upon the same leaf-nodes, including that between the uncorticated basal and the lowest of the corticated leaf-internodes: 10-40 cm. high, bright-green to grayish, lightly to heavily incrustated, robust; stems 0.9-1.4 mm. in diameter, triply corticated; spine-cells few except on youngest internodes, 0.15-0.7 mm. long: stipulodes forming a double whorl at each node, those in the upper whorl 0.5-1 mm. long, linear to lanceolate, not exceeding and usually considerably shorter than the uncorticated basal leaf-internodes: leaves 12-16 in a whorl, 2-4 cm. long, usually containing 10-13 internodes, all the latter triply corticated except the basal one, and the apical cell, which are uncorticated; leaflets at all nodes greatly reduced, 0.15-0.3 mm. long, usually near the lower limit, or much more rarely those at the uppermost leaf-nodes 0.5 mm. long, as bracteoles the anterior pair 0.5-1.2 mm. long, always shorter than the sporocarps, posterior bracteoles greatly reduced or obsolete, usually 0.08-0.2 mm. long, very rarely somewhat longer: sporocarps 0.98-1.4 mm. long, 0.63-0.75 mm. wide; oöspores 0.6-0.9 mm. long, 0.35-0.56 mm. wide, with 12-16 striae; whorl of crown-cells 0.16-0.19 mm. high, 0.17-0.25 mm. wide at base, the individual cells lanceolate, erect or appressed, sometimes early deciduous.

Type locality: Haïti.

Distribution: Illinois and Virginia to Mexico, the West Indies and South America.

Illustrations: Dict. Sci. Nat. *loc. cit.*; Kütz. Tab. Phyc. 7: *pl.* 77. *f.* 2.

Exsiccatae: Allen, Char. Am. Exsicc. 9, from Harper's Ferry, Virginia, and Mount Carmel, Illinois.

There seem to be two forms in this, represented by the two specific names by which the species was first known, *C. haitensis* having somewhat longer leaflets and posterior bracteoles than *C. polyphylla*. The extreme forms are fairly distinct, but there is considerable variation on single plants and many intermediates occur. Still longer leaflets and bracteoles would bring the plant within the limits of *C. foliolosa*, and this in turn links though not closely with *C. elegans*. More difficult are some forms most frequent in the Mississippi valley, which lie between typical *C.*

polyphylla and *C. trichacantha*, and are here doubtfully assigned to the former. They may not unlikely prove different from both. *C. haitensis* is well represented by Nash & Taylor, *no. 1470*, San Michel to Marmelade, Haïti, August 6, 1905.

44. *Chara conjungens* (A. Br.) -

C. (polyphylla) conjungens A. Br. Monatsber. Königl. Akad. Wissensch. Berlin **1858**: 363. 1858.

C. gymnopus conjungens A. Br. (; Allen, Char. Am. 2. 1880; name only) Fragm. Monogr. Char. 94. 1882.

Monoecious, the antheridia and oögonia borne upon the same leaf-nodes, the lowest at that between the lowest and second of the corticated leaf-internodes: 15-50 cm. high, light- or bluish-green, moderately incrustated; stems 0.63-1.5 mm. in diameter, triply corticated; spine-cells 0.3-1.5 mm long: stipulodes forming a double whorl at each node, those in the upper whorl 0.7-0.82 mm. long, equaling or exceeding the uncorticated basal leaf-internode; stipulodes of lower whorl 0.44-0.62 mm. long: leaves 11-14 in a whorl, 1-2 cm. long, containing 9-12 internodes, all triply corticated, except the uncorticated basal one and the leaf-tip, which also is uncorticated, the uncorticated basal internode 1-1½ times as long as wide; leaflets at sterile nodes 0.16-0.23 mm. long, those at the lowest leaf-node ventricose, different from those at succeeding nodes, as bracteoles the anterior 0.96-1.2 mm. long, the posterior 0.12-0.23 mm. long: antheridia 0.35-0.4 mm. in diameter; sporocarps 1.1-1.24 mm. long; oöspores 0.72-0.78 mm. long, 0.48-0.54 mm. wide, with somewhat connivent crown-cells.

Type locality: Caracas, Venezuela.

Distribution: Texas to South America.

The measurements given above are taken in part from Braun's descriptions, partly from Müller *no. 354*, Orizaba, Mexico. Plants more or less referable here have been collected from as far north as Lake Erie. They are probably better placed with *C. haitensis*, and may be distinct from both. No South American material of this species has been available for examination.

45. *CHARA INDICA* Bertero; Spreng. Syst. Veg. 4¹: 346. 1827

C. polyphylla guadeloupensis A. Br. Boston Jour. Nat. Hist. 5: 264. 1845.

C. polyphylla Berteroi A. Br.; Kütz. Tab. Phyc. 7: 24. *pl. 57. f. 1.* 1857.

C. polyphylla subglabra Kütz. *loc. cit.* 30. *pl. 76. f. 2.* 1857.

C. (polyphylla) Berteroi A. Br.; Monatsber. Königl. Akad. Wissensch. Berlin **1858**: 364. 1858.

C. gymnopus Berteroi A. Br. (; Allen, Bull. Torrey Club 7: 107. 1880; name only) Fragm. Monogr. Char. 195. 1882.

Monoecious, the antheridia and oögonia borne upon the same leaf-nodes, the lowest at that between the first and second lowest corticated leaf-internodes: elongated, light-green, slightly incrustated; stems 0.7–1 mm. in diameter, very regularly triply corticated, the cortical cells very long, at least on mature internodes, the end walls of the secondary cells very oblique, thus interposing a third cell between two consecutive primaries, though for a comparatively short distance; spine-cells 0.25–0.82 mm. long: stipulodes forming a double whorl at each node, those in the upper whorl 0.5–1.1 mm. long, usually slightly exceeding the uncorticated basal internode of the leaves, stipulodes of lower whorl 0.25–0.55 mm. long: leaves 10–15 in a whorl, 1.2–2 cm. long, containing 8–13 internodes, all triply corticated except the tip and the basal one, which are uncorticated, basal uncorticated internode much shorter than the succeeding ones, its length about equal to its diameter; very exceptionally the entire leaf uncorticated; leaflets at sterile nodes greatly reduced, mostly 0.08–0.2 mm. long, the anterior usually a little the longer, as bracteoles the anterior well developed, 0.96–1.4 mm. long, but the posterior very short, 0.08–0.16 mm. long, the anterior reaching about as far as the tops of the mature sporocarps, or often a little less, but overtopping immature sporocarps: antheridia 0.42–0.47 mm. in diameter; sporocarps 0.85–1.25 mm. long, 0.5–0.65 mm. wide; oöspores 0.57–0.68 mm. long, 0.35–0.45 mm. wide, with 8–10 striae; whorl of crown-cells 0.19–0.23 mm. high, 0.21–0.25 mm. wide at base, the individual cells lanceolate, connivent.

Type locality: Guadeloupe, West Indies.

Distribution: Bermuda to South America; Mexico, and Guatemala.

Illustrations: Kütz. *loc. cit.*

46. *Chara trichacantha* (A. Br.)

C. gymnopus trichacantha A. Br. (; Allen, Char. Am. 2. 1880; name only) Fragm. Monogr. Char. 190. 1882.

Monoecious, the antheridia and oögonia borne on the same leaf-nodes: 15–30 cm. high, pale-green, glistening, slightly incrustated; stems 0.5–0.75 mm. in diameter, somewhat irregularly triply corticated; spine-cells variable, 0.24–0.8 mm. long, with an extreme diameter at base of 0.07 mm.: stipulodes forming a double whorl at each node, those in the upper whorl 0.63–0.88 mm. long and 0.08–0.1 mm. wide, slightly exceeding the uncorticated basal leaf-internodes; stipulodes of lower whorl 0.44–0.49 mm. long: leaves 12 or 13 in a whorl, 1.5–2 cm. long, containing 12–15 internodes, all except the tip and the basal one uncorticated, the latter about

0.47–0.5 mm. long, 0.28–0.35 mm. wide; leaflets at sterile nodes greatly reduced, 0.05–0.16 mm. long, or almost obsolete at the upper nodes, lanceolate to ovate, sometimes ventricose, those on the node between the uncorticated basal and the lowest of the corticated internodes 0.16–0.26 mm. long, ovate, mostly ventricose, usually spreading or even reflexed, as bracteoles the anterior 0.56–0.77 mm. long, not exceeding the sporocarps, the posterior 0.04–0.21 mm. long: antheridia 0.28–0.37 mm. in diameter; the doubtfully mature sporocarps examined 0.84–0.91 mm. long, 0.56–0.6 mm. wide; oöspores 0.63–0.65 mm. long, 0.4–0.58 mm. wide, with 12–14 striae (oöspores according to Braun 0.6–0.66 mm. long, 0.46–0.52 mm. wide, with 14 or 15 striae); whorl of crown-cells 0.12–0.16 mm. high, 0.16–0.21 mm. wide, the individual cells lanceolate, diverging.

Type locality: Main canal or Comanche Creek, southwestern Texas.

Distribution: Texas to South Carolina and Florida, according to Braun and Allen. Several plants referred here by them, however, belong to *C. sejuncta*, others are young stages of *C. foliolosa*.

47. *Chara Brittonii* Allen, sp. nov. (Britton, Cat. Pl. N. J. 356. 1889; without description)

Monoecious, but the antheridia and oögonia usually though not always at different leaf-nodes: possibly allied to *C. sejuncta* A. Br.; 1–2 cm. high, cespitose, slightly incrusting; stems 0.2–0.6 mm. in diameter, different internodes varying greatly, entirely without cortex and spine-cells: stipulodes forming a double whorl at each node, usually of nearly equal size, 0.9–1.2 mm. long, 0.04–0.06 mm. wide, or those in the upper row sometimes much longer, attaining a maximum length of 2 mm., sometimes also very short: leaves 7–9 in a whorl, 5–8 mm. long (the whorls overlapping), 0.16–0.25 mm. wide, containing 4 or 5 articulations, the node-cells small and apparently sometimes absent; lowest leaf-internode often oval, broader than the rest, resembling that of many species of the *gymnopus* group; leaflets at sterile nodes usually unequal, 0.3–1.2 mm. long, or like the bracteoles, the latter 0.7–1.8 mm. long, 0.035–0.06 mm. wide, far exceeding the sporocarps: antheridia 0.25–0.28 mm. in diameter; mature sporocarps 0.85–0.93 mm. long, 0.6–0.65 mm. wide; oöspores 0.6–0.65 mm. long, 0.4–0.47 mm. wide, with 14 striae; crown-cells ovate, 0.08–0.11 mm. high, closely connivent.

Type collected 2 miles southwest of Sparta, Sussex County, New Jersey, by N. L. Britton, September 16, 1887; in the herbarium of the New York Botanical Garden.

Distribution: Only known from original collection.

Illustration: Allen, *pl.* 53, as “Britton’s *Chara*.”

48. *Chara formosa* sp. nov.

Monoecious, but the antheridia and oögonia borne at different leaf-nodes: 4-30 cm. high, slightly incrustated; stems 0.4-1 mm. in diameter, very regularly triply corticated, spine-cells only conspicuous on youngest internodes, 0.2-0.5 mm. long: stipulodes forming a double whorl at each node, those in the upper 0.6-0.92 mm. long, much exceeding the uncorticated internode basal of the leaves, stipulodes of the lower whorl 0.23-0.53 mm. long: leaves 10-15 in each whorl, 1.2-2.5 cm. long, containing 11 or 12 internodes, all triply corticated except the lowest one and the apical cell, which are uncorticated, the uncorticated basal internode 0.2-0.35 mm. long, cylindric; leaflets at sterile nodes 0.25-0.6 mm. long, not conspicuously different, but the anterior usually somewhat the longer, as bracteoles usually with two longer pairs enveloping the sporocarp, and two smaller posterior pairs, the anterior pair 1-2.5 mm. long, the second (lateral) pair sometimes equaling the anterior but more often somewhat shorter, both pairs much exceeding the sporocarps, the posterior pairs 0.23-0.5 mm. long: antheridia 0.28-0.38 mm. in diameter; sporocarps 0.92-0.96 mm. long, 0.47-0.49 mm. wide; oöspores 0.75-0.82 mm. long, 0.38-0.44 mm. wide, with 14-16 very faint striae; whorl of crown-cells 0.1-0.14 mm. high, 0.12-0.21 mm. wide at base, the individual cells lanceolate, usually spreading.

Type collected at Panther Pond, New Jersey, by T. F. Allen, August 1, 1880; in the herbarium of the New York Botanical Garden.

Distribution: New Jersey to Iowa.

49. *CHARA SEJUNCTA* A. Br. Boston Jour. Nat. Hist. 5: 264.
1845

C. sejuncta brevibracteata A. Br. loc. cit.

Monoecious, but the antheridia and oögonia almost invariably at different leaf-nodes: 8-60 cm. high, only slightly incrustated; stems 0.25-0.96 mm. in diameter, very regularly triply corticated; spine-cells scattered on lower internodes, but usually somewhat crowded above, 0.09-0.37 mm. long: stipulodes forming a double whorl at each node, those in the upper whorl 0.56-0.82 mm. long, usually considerably longer than the uncorticated basal internodes of the leaves, and concealing the true character of the latter, stipulodes of lower whorl usually 0.26-0.32 mm. long: leaves 9-13 in a whorl, 1.2-4 cm. long, containing 10-15 internodes, all of which are triply corticated except the basal one and the apical cell, which are uncorticated, the uncorticated basal internode 0.25-0.5 mm. long, not or but slightly wider than the succeeding corticated ones; leaflets at sterile nodes 0.1-0.5 mm. long, usually nearer the lower limit and

then often nearly equal on all sides of the leaf, when of greater length the anterior usually much exceeding the posterior, as bracteoles not more than two pairs well developed, often only one pair, 0.6–0.92 mm. long, closely investing the sporocarps, all shorter than the latter when mature, the posterior very short or reduced to papillae: antheridia 0.3–0.48 mm. in diameter; mature sporocarps 0.96–1.26 mm. long, 0.5–0.68 mm. wide; oöspores 0.66–0.91 mm. long, 0.42–0.6 mm. wide, with 12–15 striae; whorl of crown-cells 0.12–0.26 mm. high, 0.18–0.26 mm. wide at base, the individual cells lanceolate, rounded at the apex, spreading, often very widely.

Type locality: Lakes in the lowlands of the Mississippi, Illinois, opposite St. Louis, Missouri.

Distribution: Massachusetts and Alabama to Minnesota and Mexico; also reported from South America.

Illustration: Woods, Flor. Neb. 1: *pl.* 36.

Exsiccatae: Allen, Char. Am. Exsicc. 7, 25, 39.

50. *Chara compacta* sp. nov.

C. sejuncta Allen, Bull. Torrey Club 21: 526. 1894.

Monoecious, but the antheridia and oögonia at different leaf-nodes: 15–20 cm. high, slightly incrustate; stem 0.75–1 mm. in diameter, very regularly triply corticated; spine-cells almost wanting on lower internodes, more frequent above, 0.23–0.37 mm. long: stipulodes forming a double whorl at each node, those in the upper whorl 0.92–1.5 mm. long, usually not quite reaching the top of the swollen basal internodes of the leaves, stipulodes of the lower whorl 0.37–0.5 mm. long: leaves 12–14 in a whorl, 1.5–2.2 cm. long, containing 12–14 internodes, all of which are triply corticated except the basal one and the apex, which are uncorticated, the uncorticated basal internode barrel-shaped, 0.7–0.88 mm. long; leaflets at the sterile nodes 0.16–0.24 mm. long, the anterior and posterior usually nearly equal, as bracteoles two pairs usually well developed, of nearly equal length or the anterior one-half longer, and one, very rarely two more pairs less so, but usually evident, the former 0.6–1.12 mm. long, the latter 0.2–0.48 mm. long, all shorter than the sporocarps: antheridia 0.36–0.4 mm. in diameter; sporocarps 1.12–1.28 mm. long, 0.6–0.77 mm. wide, the envelope unusually thick; oöspore 0.73–0.77 mm. long, 0.48–0.55 mm. wide, with 10–12 very conspicuous striae; whorl of crown-cells 0.21–0.25 mm. high, 0.3–0.32 mm. wide at base, the individual cells ovate, beaked.

Type collected in Lake Saratoga, New York, by T. F. Allen, August, 1894; in the herbarium of the New York Botanical Garden.

Distribution: Lakes Champlain and Saratoga.

Exsiccatae: Allen, Char. Am. Exsicc. as *C. sejuncta*, from both the localities named, but without number.

SPECIES DUBIAE VEL EXCLUDENDAE

- C. capitata* Elliott, Sketch Bot. S. Car. Georg. 2: 516. 1824.
(Not *C. capitata* Nees) = *C. capitellata* A. Br. Am. Jour. Sci. 46: 93. 1844 = *C. Elliottii* A. Br. nomen = *Nitella capitellata* A. Br.
- C. flexilis* A. Br. Am. Jour. Sci. 46: 92. 1844. = *Nitella flexilis* Ag.
- C. glabra* Muhl. Cat. Pl. Am. Sept. 82. 1813. = ?
- C. glomerulifolia* A. Br. Am. Jour. Sci. 46: 92. 1844. = *Nitella glomerulifera* A. Br.
- C. humilis* Riddell, Flor. W. States. 110. 1835. = ? *C. fragilis*.
- C. mucronata americana*? A. Br. Am. Jour. Sci. 46: 92. 1844. = *Nitella* sp.
- C. sabulosa* Riddell, loc. cit. = ? *C. haitensis*.
- C. sabulosa spiralis* Riddell, loc. cit. = ?
- C. squamosa*? Riddell, loc. cit. 109 = ?
- C. tenuis* Muhl. Cat. Pl. Am. Sept. 82. 1813. = *Nitella flexilis* prob., fide MS. note by Braun.
- C. tenuissima* A. Br. Am. Jour. Sci. 46: 93. 1844. = *Nitella tenuissima* Kütz.
- C. tenuissima americana* A. Br. Boston Jour. Nat. Hist. 5: 264. 1845. = *Nitella tenuissima americana* A. Br.

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INDEX OF SPECIFIC AND VARIETAL NAMES

- americana*, 262, 298.
armata, 291.
aspera, 256, 280, 281, 282.

baltica, 255, 267.
Berteroi, 293, 294.
Braunii, 252, 254, 255, 258, 259, 302.
brevibracteata, 296.
brevifolia, 278.
Brittonii, 255, 295.

canescens, 249, 255, 262.
capillacea, 280.
capitata, 298, 302.
capitellata, 298.
carmenensis, 257, 287.
ceratophylla, 277.
clavata, 302.
compacta, 258, 297.
compressa, 290, 291, 303.
conjungens, 257, 293.
contraria, 255, 260, 265, 266, 267.
coronata, 258, 259, 298.
coronatiformis, 256, 271.
crassicaulis, 268, 269.
crinita, 249, 262.
crinitiformis, 255, 260, 266.
Crügeriana, 284, 285.
cubensis, 257, 282.
Curtissii, 256, 272.

delicatulata, 280.
depauperata, 290, 291.
dissoluta, 263.

elegans, 257, 283, 289, 292.
Elliottii, 298.
evoluta, 249, 255, 261.
excelsa, 255, 260, 266.

fertilissima, 257, 286.
filicaulis, 257, 285.
flaccida, 272.
flexilis, 298.
foetida, 268, 269, 302.
foliolosa, 252, 257, 259, 260, 283, 290, 292, 295, 306.
foliosa, 290, 304.
formosa, 257, 296.
fragilis, 249, 256, 264, 270, 278, 279, 280, 298.
glabra, 298.

globularis, 280.
glomerulifera, 298.
glomerulifolia, 298.
gracilis, 258.
guadeloupensis, 293.
guatemalensis, 256, 286.
gymnopitys, 249, 273.
gymnopus, 254, 276, 283, 284, 286, 289, 290, 291, 292, 293, 294, 295, 299, 302.

haitensis, 252, 257, 291, 292, 293, 298, 301.
Hicksiana, 287.
Hicksii, 257, 287, 302.
hirsuta, 249, 255, 261.
hispida, 267.
Hornemannii, 256, 273, 277, 278.
Humboldtiana, 290.
Humboldtii, 290.
humilis, 298.
hydropitys, 274, 275.
hypnoides, 255, 263.

imperfecta, 263.
inconnexa, 255, 264.
inconstans, 256, 257, 283, 284, 287.
indica, 257, 291, 293.
intermedia, 267.
intumescens, 255, 268.

keukensis, 249, 256, 271, 273.

leptosperma, 256, 278.
Liebmanni, 256, 274.
longifolia, 256, 272.

Macounii, 256, 281.
majuscula, 275.
Martiana, 276.
mexicana, 256, 274.
Michauxii, 291, 292.
minor, 290.
Morongii, 255, 256, 270.
mucronata, 298.
Muhlenbergii, 290.

nidifica, 260.
nitidula, 281.
Nordhoffiae, 256, 277.
novi-mexicana, 258.
nudipes, 275.

obtusa, 252, 273.

- Oerstediana*, 284, 285.
pallida, 255, 258.
perfecta, 274.
polyphylla, 290, 291, 292, 293, 295, 306.
pulchella, 264.
Robbinsii, 256, 275.
sabulosa, 298.
Sanctae-Margaritae, 257, 289.
Schaffneri, 255, 264.
Schneckii, 256, 271.
Schweinitzii, 253, 255, 259, 260, 271.
sejuncta, 257, 276, 277, 295, 296, 297, 299.
septentrionalis, 275.
spiralis, 298.
squamosa, 298.
stellata, 257, 288.
subglabra, 293.
tenera, 258.
tenuis, 298.
tenuispina, 264.
tenuissima, 298.
trichacantha, 257, 293, 294.
verrucosa, 256, 280.
verticillata, 291.
vulgaris, 254, 255, 269, 279, 300.
Wikströmii, 290.
zeylanica, 283, 284, 291.

